JULY 13, 1953

Electrical World

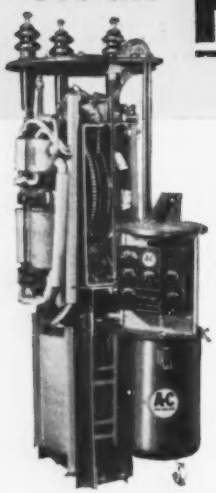
Price 35 Cents

A McGRAW-HILL PUBLICATION

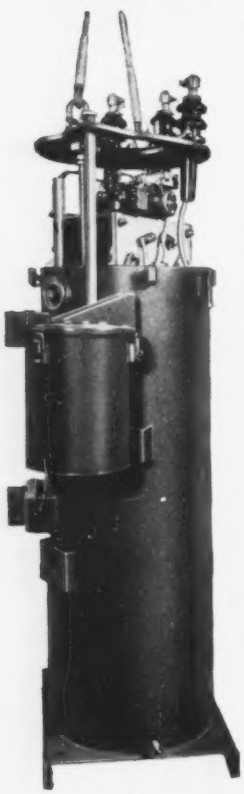
See Page 121

LOOK INSIDE

Get the **FULL** *Profit Story*



Look at Design. Real proof of quality comes only from a point-by-point comparison when you look inside a voltage regulator. Inside an Allis-Chalmers distribution regulator you'll find the reasons why you get ± 1 volt accuracy and 20% range of regulation over years and years of relatively trouble-free operation.



Look at Workmanship. Unit construction — an exclusive feature of A-C 5/8% step voltage regulators — is the reason why you get highest quality workmanship. Transformer, mechanism, control, cover and bushings are built as an integral unit. As a result, *all* connections can be made before tanking. And inspection can be accurate and thorough — thanks to such easy accessibility.

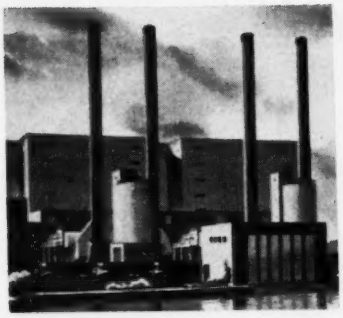
Then...Look at the Record.
Only from Allis-Chalmers do you get field experience that proves accuracy and reliability. A-C distribution regulators have been turning in profitable field records since 1944 — and they are based on a total of 20 years of 5/8% step regulator experience. It will pay you to get all the facts. Call the A-C district office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4104

RATINGS AVAILABLE	7620 Volts—15, 50, 100 amp 5000 Volts—50, 100 amp 2500 Volts—100, 200 amp

ALLIS-CHALMERS

Originators of 5/8% Step Regulation



On Steam Station Surveys

"Facts instead of opinions should prevail in power station design."

". . . . . there is one primary object and that is to get a reliable supply of energy at a minimum total cost to the station and to the utility system."

The quotations above were taken from the text of the first Steam Station Cost Survey published by EW October 27, 1928. That survey occupied a total of five pages.

25 Years Ago. . . . In all, the 1928 survey covered 136 steam stations then in operation. And a pattern was set at that time that is in many respects still being followed in 1953.

For the first time there was made available to all members of the industry a source of reliable, up to date, concise data on real costs. No more guesswork, no more hearsay. These were the facts, confidentially gathered and intelligently analyzed.

Changing Times. . . . The seven surveys that followed the first one have changed the basic pattern but little.

True, modern typography and illustration methods have done much to make the subject matter easier to absorb. More searching analysis of the statistics has made a simpler job for the reader, a more thoughtful and time-consuming task for the perennial editor, Archer E. Knowlton. Additional information covering new features has made the overall picture progressively more comprehensive—and the data cannot be found anywhere else.

But the real reason for the 16-page Eighth Steam Station Cost Survey (starting on page 121) is still—

"Facts instead of opinions."

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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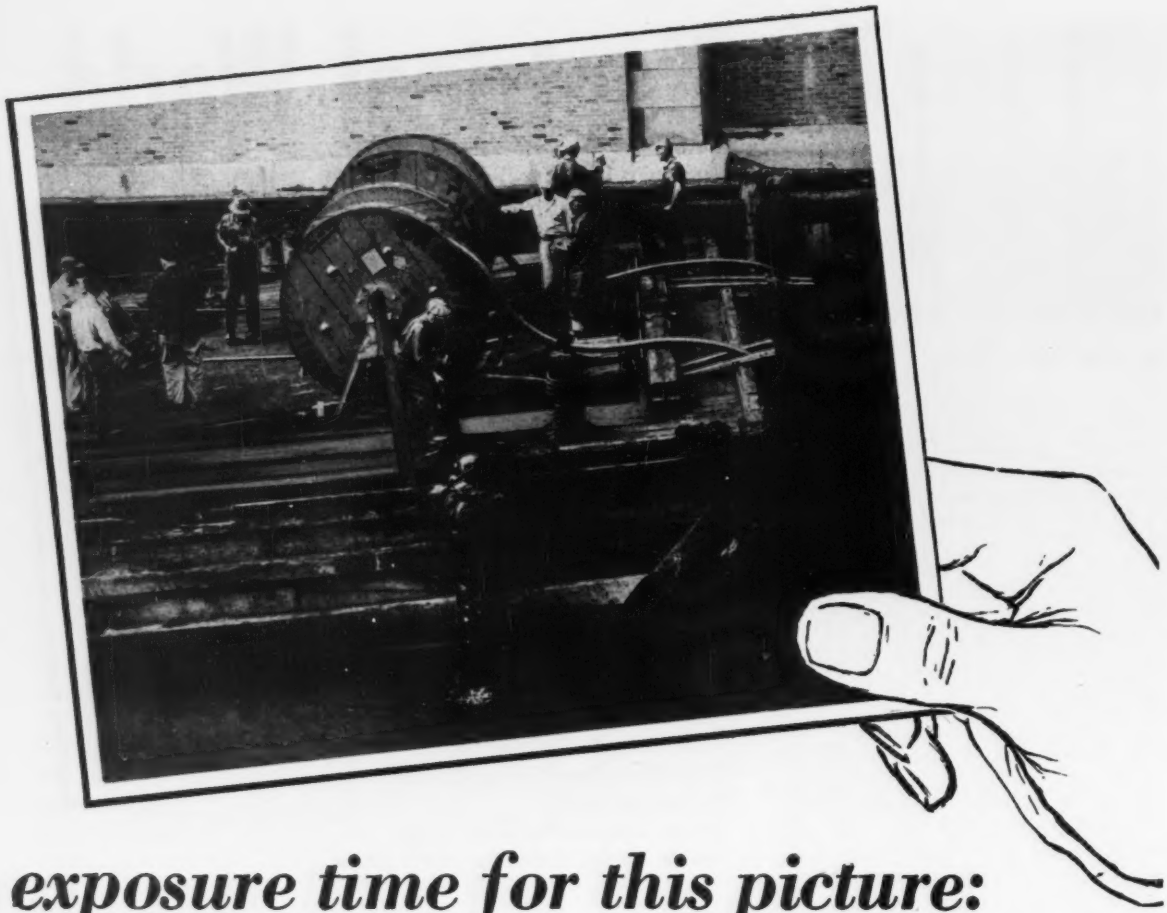


exposure time for this picture:

75 years

It took 75 years of Okonite research, engineering, and on-the-job experience to make this picture possible. For a submarine cable typifies Okonite's unusual skills in making insulated cables.

During the past 75 years Okonite has made many pioneering contributions to this type of cable in its gradual evolution to today's position of "watertight integrity." Okonite installed the first 69,000-volt, paper-insulated, lead-sheathed submarine cable in 1928 at Deepwater, Delaware. This company also made the first 132,000-volt, pipe-type submarine cable, which crosses the Hudson River at Newburgh, N. Y.

Perhaps the highest achievement in this industrial art is the now famous "Bonneville Cable," installed in 1951 in Puget Sound. This record-size cable has taken its place alongside 18 other Okonite submarine cables now operating in the Puget Sound area, some of which were installed over 25 years ago.

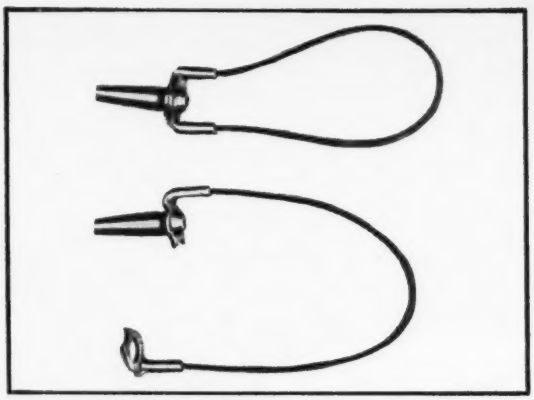
Since 1878, Okonite's one concern has been to make longer-lived cables. Over these years Okonite research has yielded an unusually high number of new materials, processes and techniques. They were confirmed first by Okonite's advanced testing procedures, and second, by the even more exacting test of service experience. The Okonite Company, Passaic, New Jersey.

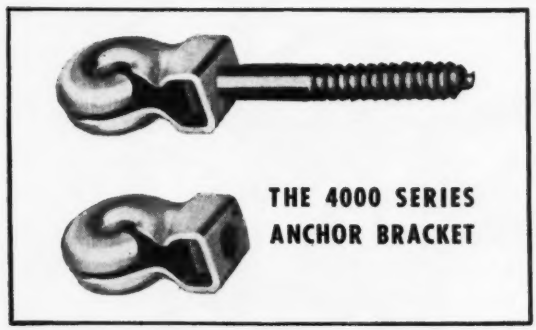
OKONITE SINCE 1878 *insulated cables* 75

1G42

Electroline AUTOMATIC DEAD-END

for Neutral Supported Multiple Conductor Service-Drop Cable





THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

WRITE FOR NEW BULLETINS FOR FULL INFORMATION

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Electroline Company

4121 South La Salle Street • Chicago 9, Illinois

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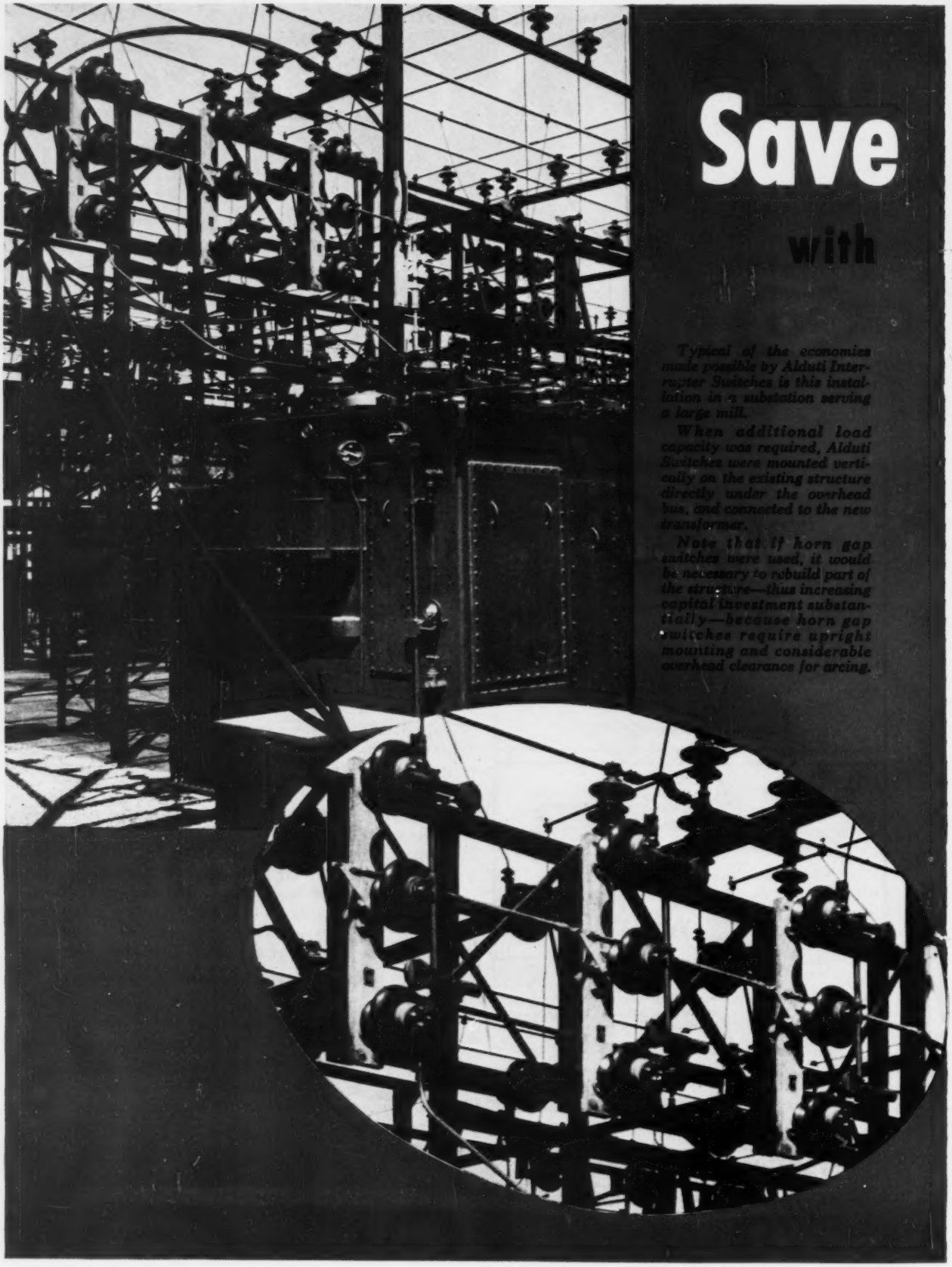


Save

with

Typical of the economies made possible by Alduti Interrupter Switches is this installation in a substation serving a large mill.

When additional load capacity was required, Alduti Switches were mounted vertically on the existing structure directly under the overhead bus, and connected to the new transformer.

Note that if horn gap switches were used, it would be necessary to rebuild part of the structure—thus increasing capital investment substantially—because horn gap switches require upright mounting and considerable overhead clearance for arcing.

Capital Investment

Alduti* Interrupter Switches

They are taking the place of disconnect switches and horn gap switches because of their current interrupting capacity, and because their *confined-arc* operation permits vertical or inverted mounting—saves structure cost.

They are also taking the place of more expensive equipment . . . reducing investment . . . and providing safe, dependable interruption for high-voltage power circuits.

*Alduti is pronounced "All Duty" and signifies the ability of these switches to interrupt magnetizing and charging currents as well as 600-ampere load currents. It also signifies their wide applicability to sectionalizing, preferred-emergency throwover, bus transfer, capacitor bank switching, and to transformer primaries, transformer secondaries, and metal-clad applications such as power centers and unit substations.

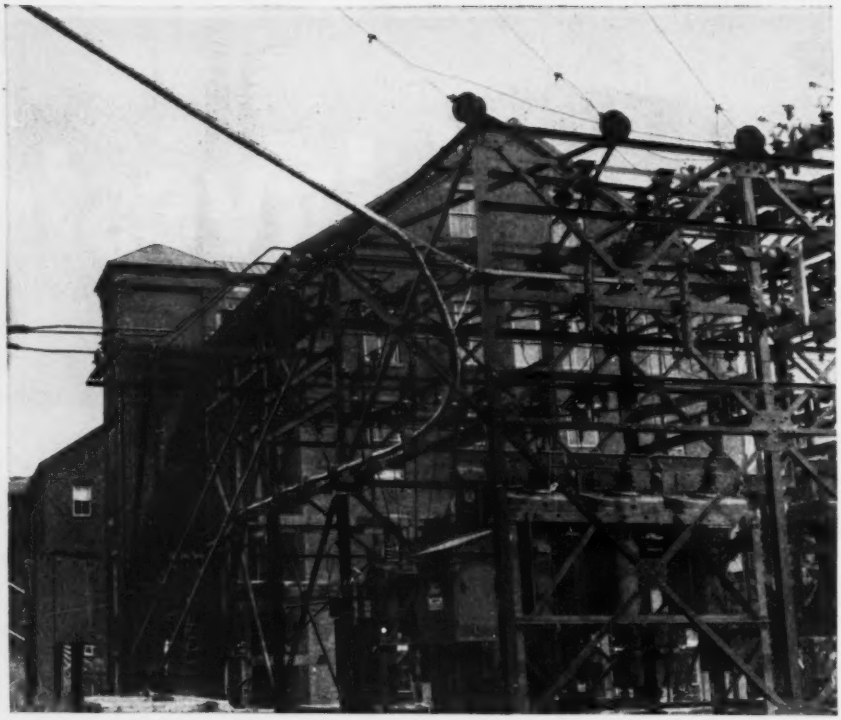
ALDUTI INTERRUPTER SWITCHES encourage **NEW THINKING** in system layout, and show **NEW POSSIBILITIES** for versatility in arrangement, and for economy. May we send you this booklet containing **NEW CONCEPTS** of circuit interruption? A note to S&C on your letterhead will bring it.

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.
Formerly Schweitzer & Conrad, Inc.

SPECIALISTS IN HIGH-VOLTAGE CIRCUIT INTERRUPTION

"neither snow, nor rain, nor heat...."



These famous words* carved over the main entrance of the New York Post Office very aptly apply to the public utility systems of this country.

Distribution systems of public utilities must be as dependable and constant as the proverbial postman in his appointed rounds. That's why it is false economy to buy distribution wire and cable of any kind that isn't the most dependable that money can buy. It isn't a question of whether you can afford to buy the best; the question should be turned around, "Can you afford not to buy the best?"

For high voltage circuits, we think you are practicing false economy if you don't install cables insulated with Simplex-ANHYDREX XX. These cables can be used underground in or out of ducts, or overhead on messenger wire. They are heat, ozone, water and age resistant. They are rated for operation at 80°C. in wet or dry locations at voltages from 2,001 to 17,000 V.W.P.

Why don't you insure the continued operation of your distribution circuits by installing Simplex-ANHYDREX XX Cables now?

** The complete quotation is, "Neither snow, nor rain, nor heat, nor gloom of night stay these couriers from the swift completion of their appointed rounds."*

Simplex WIRES & CABLES

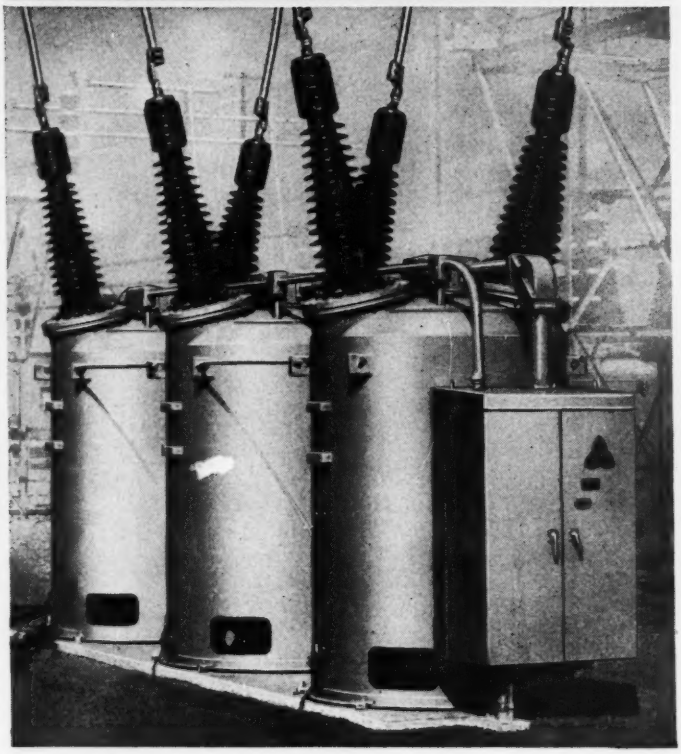
SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

Advanced Protection for Present and Future Loads

PACIFIC ELECTRIC
Type RHE
CIRCUIT BREAKERS
ASA, AIEE, and NEMA STANDARD

Projection of load growth and of maximum fault current may indicate the selection of breakers of far higher rating than present load requires.

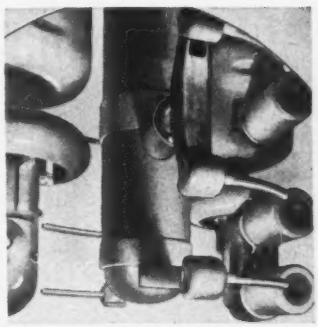
115, 138, 161 kv — 3 or 5 cycles
196/230, 230, and 287 kv — 3 cycles
to 10,000,000 interrupting kva (ASA)
at 161, 230, and 287 kv

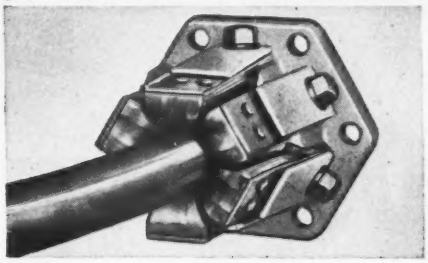


At Left:
One of Fifteen Type RHE-78, 161 kv, 10,000,000 int. kva for Electric Energy, Inc., Joppa, Illinois.

At Right:
Interior of Tank; a single rotary structure connects six interrupters in series (three are shown).

Below:
Moving Contact Entering Nest of Six Sliding-Shoe (finger) Contacts.





These features contribute to Pacific's Proved Protective Performance . . .

Nested Sliding-Shoe Contacts

PACIFIC'S Continued use of the reliable nested sliding-shoe (finger) form of contact, even for the largest circuit breakers, is now supported by the industry trend when severe conditions are to be met.

The stationary and moving contact surfaces of the contacts are silver Elkonite, of such form that arc foot prints are confined to portions of the surfaces that do not carry load current.

The stationary contact structure of each pole comprises six sets of contacts in series, each of either four or six shoes, depending on rating. Voltage division between the sets of contacts is aided by capacitance grading shields.

Proved Interrupters

Pacific interrupters are of simple self-pressurizing type; their exceptional performance is due to improved utilization of directed oil flow and to high speed of developing open-gap distance.

Other Features

- Only one moving structure within the tank.
- Opening accelerating springs and shock absorbers are outside of the tank.
- Oil-hydraulic restoration of closing energy.
- Easy manual emergency operation for load switching as well as for test.
- Electrically and mechanically trip free in any position, even during high-speed reclosing.

Since 1906

SALES OFFICES or AGENCIES
in PRINCIPAL CITIES

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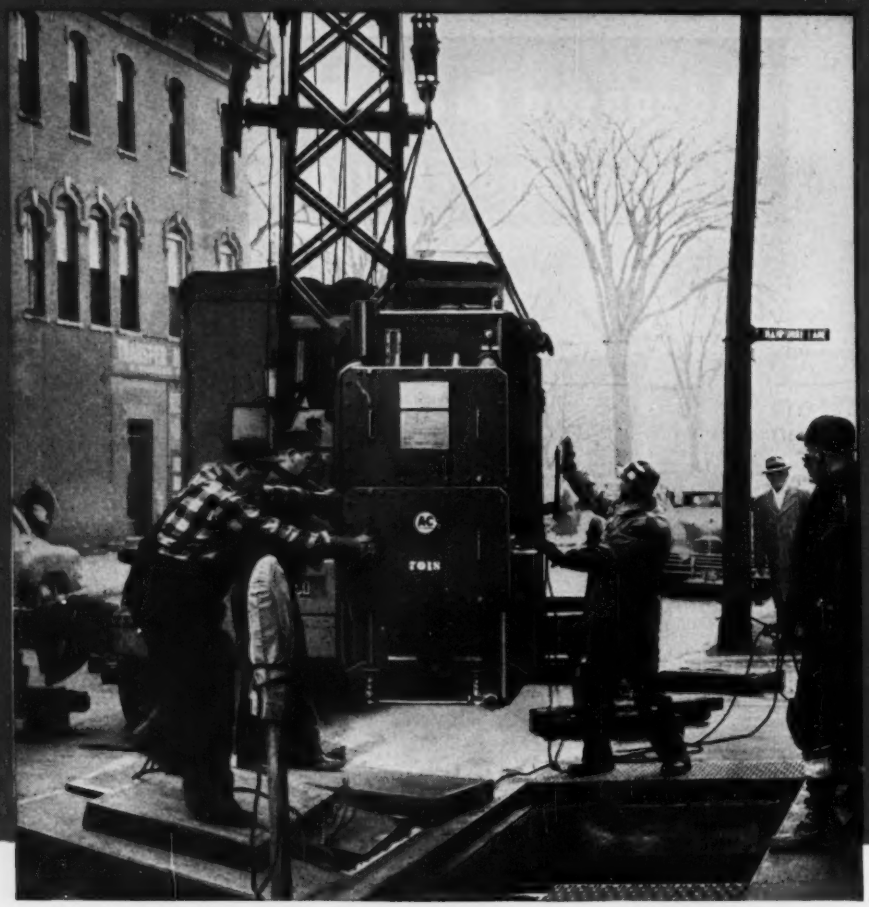
New England Utility Beats High Installation Costs



500-Kva Transformer Fits in 50-Kva Vault

When Public Service Company of New Hampshire increased many kva sizes in their network system due to load growth, it was evident that the original planning was wisely made for future expansion. The above photograph tells why. It shows a 500-kva Allis-Chalmers transformer being placed in a vault which originally housed a 50-kva transformer. Except for addition of a new vault cover, no vault changes were needed because of the new 500-kva Allis-Chalmers network transformer's compact design. Thus, installation costs were held to a minimum.

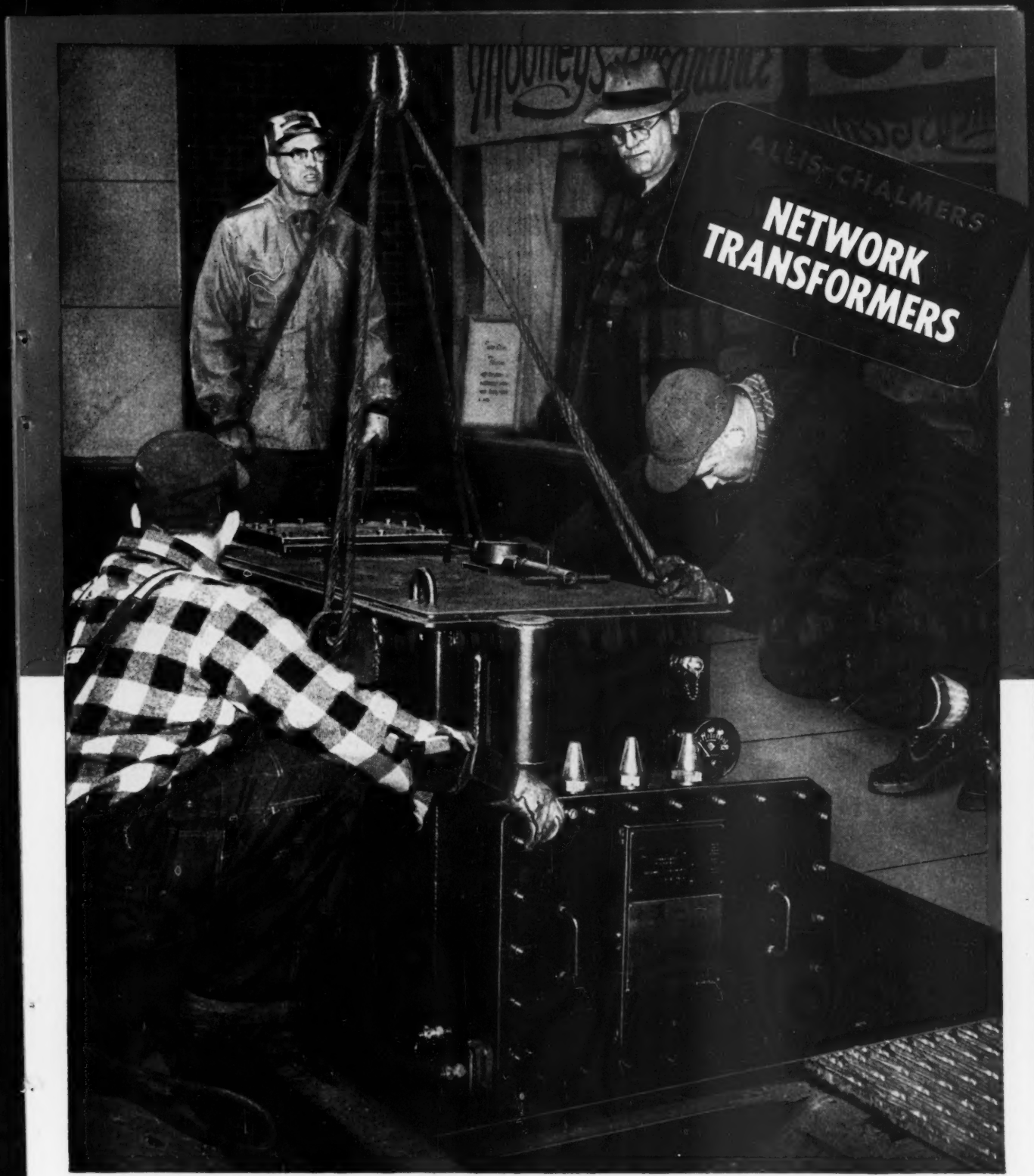
Dependability Important

Installing a transformer in close quarters like this, places greater than usual importance on dependability. The rugged construction of Allis-Chalmers transformers, backed by most careful attention to manufacturing details, enabled them to measure up to the job. For example—a special bituminous compound gives added protection to surfaces and tubes in the base area. And spiral wound metallic gaskets give the best possible sealing for bushings. Welded covers, too, help eliminate future gasket maintenance.

Equally important is the location of transformer accessories, especially when working with limited dimensions. All of the accessories are located for convenient observation or operation.

More Details Available

There are many more reasons why it will pay to investigate the advantages of Allis-Chalmers network transformers. Get more details from your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4075



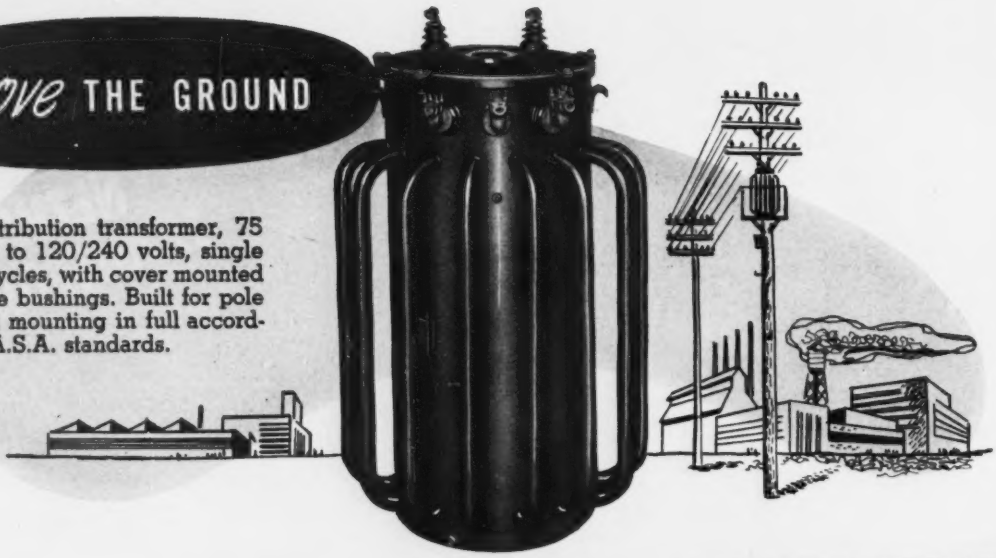
Here an Allis-Chalmers transformer is being installed at the corner of West Central Street and Hampshire Lane in Manchester, N. H. Neighborhood is an average growth area, but one where network reliability is extremely important. It includes stores, apartments, a school, and several restaurants. This 500-kva Allis-Chalmers transformer replaced a 50-kva transformer. The vault did not have to be enlarged.

ALLIS-CHALMERS

A-C
ALLIS-CHALMERS

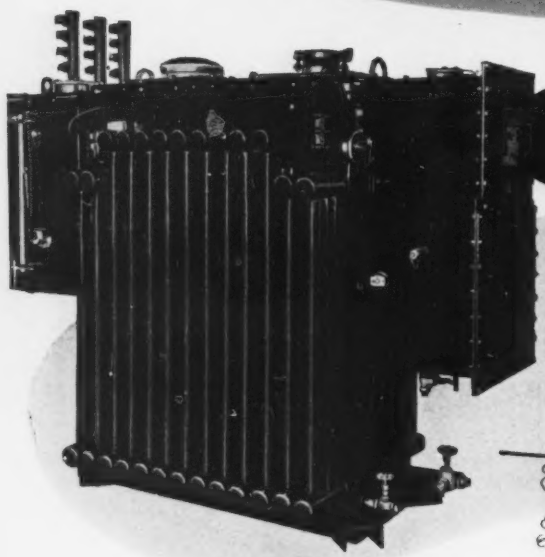
Above THE GROUND

Type A distribution transformer, 75 KVA, 2400 to 120/240 volts, single phase, 60 cycles, with cover mounted high voltage bushings. Built for pole or crossarm mounting in full accordance with A.S.A. standards.



Standard

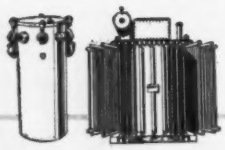
TRADE MARK



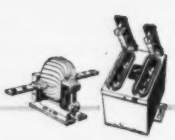
Under THE GROUND

Type HTS Askarel subway type network transformer, 500 KVA, 12,470 to 216Y/125 volts, 3 phase, 60 cycles, complete with high voltage disconnect and grounding switch, low voltage network protector, and electrical interlocks.

Transformers FOR EVERY APPLICATION

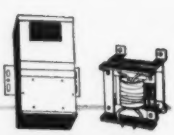


Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)

Dry type (up to 1000 KVA and max. voltage ratings of 4800.)



Control transformers (compound filled or open type.)

On THE GROUND

Type **ATAB** transformer, 10,000/12,500 **KVA**, 3 phase, 60 cycles, voltage 69,000**Y** to 13,200**Y**, with tertiary winding of 3500 **KVA**. Air blast equipment for supplemental rating, low voltage terminal chamber and wheels are accessory equipment.

TRANSFORMERS AT EVERY LEVEL

Installed on thousands of poles throughout the electrical distribution system. On the ground stepping-up or stepping-down at substations. Underground at network load centers. You find STANDARD transformers operating at every level because . . .

. . . users of electrical equipment, having learned through actual experience, place their confidence in the transformers that are built "right" from the ground up. Designed by topflight engineers, constructed by craftsmen who know the importance of following instructions to the letter, then . . .

. . . tested by STANDARD, a recognized leader in the manufacture of Testing transformers. Thus possible future trouble spots are located and eliminated before the transformer leaves the factory. Fully protected from the ravages of dust, dirt, fumes and dampness. Rugged construction allows STANDARD transformers to be used anywhere. Next time remember . . . STANDARD TRANSFORMERS.

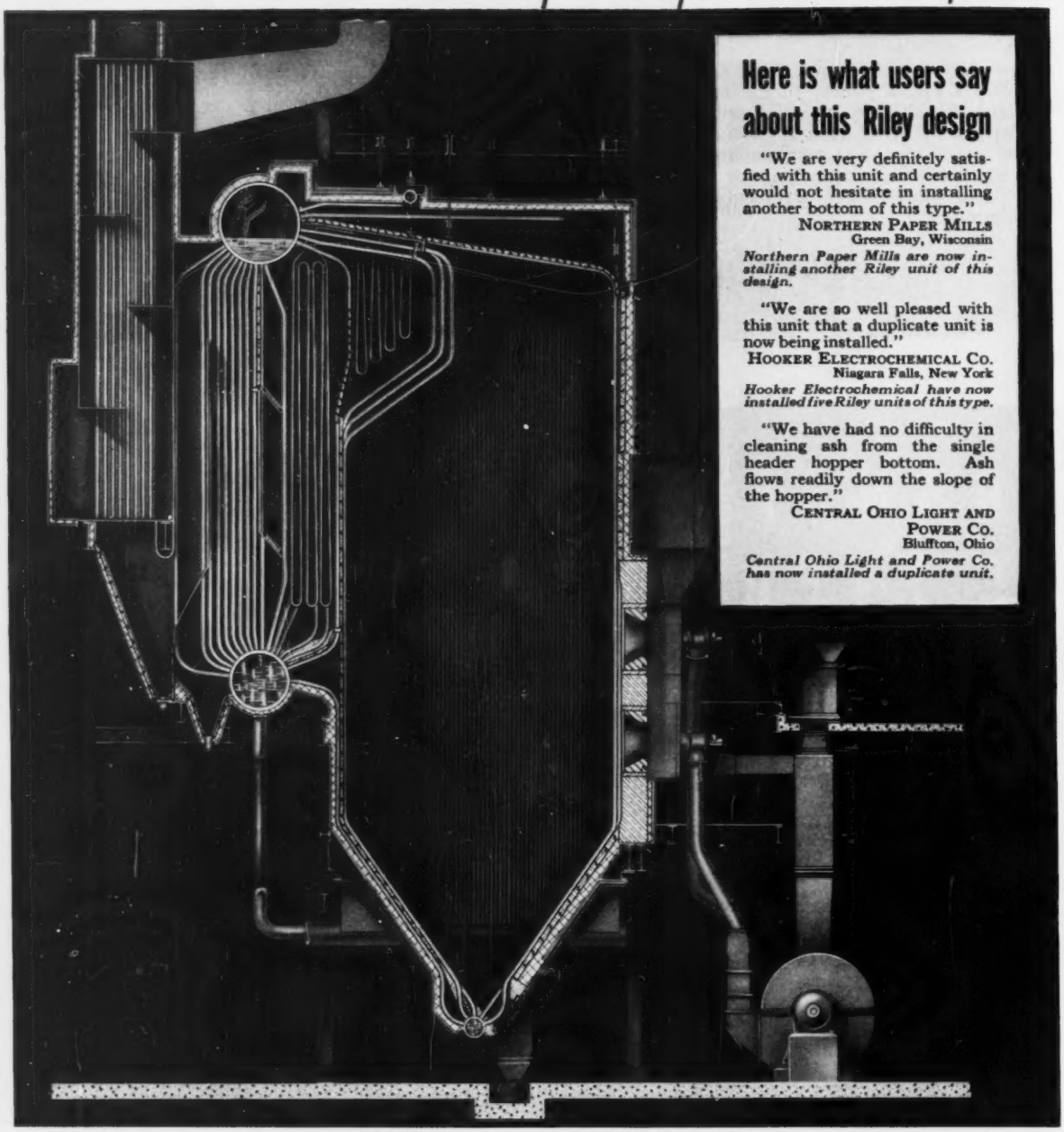
Standard

The Standard Transformer Co.

Warren, Ohio

Representatives in principal cities

You save in many ways when you



Here is what users say about this Riley design

"We are very definitely satisfied with this unit and certainly would not hesitate in installing another bottom of this type."

NORTHERN PAPER MILLS
Green Bay, Wisconsin

Northern Paper Mills are now installing another Riley unit of this design.

"We are so well pleased with this unit that a duplicate unit is now being installed."

HOOKER ELECTROCHEMICAL CO.
Niagara Falls, New York

Hooker Electrochemical have now installed five Riley units of this type.

"We have had no difficulty in cleaning ash from the single header hopper bottom. Ash flows readily down the slope of the hopper."

CENTRAL OHIO LIGHT AND POWER CO.
Bluffton, Ohio

Central Ohio Light and Power Co. has now installed a duplicate unit.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS

install this unique Riley Boiler Unit

designed for pulverized coal firing

YOU SAVE COST OF SEPARATE HOPPER

Since a water-cooled ash hopper is an integral part of the furnace with this Riley design, by installing it, you not only save the initial cost of a separate hopper but also the cost of hopper foundations and supports as well as future hopper maintenance.

YOU SAVE COST OF HOPPER SEALS

On units requiring a separate ash hopper, seals must be provided between the boiler unit and ash hopper to prevent air infiltration. With this Riley unit, you not only eliminate the difficulties of providing and maintaining positive seals but also the cost of them.

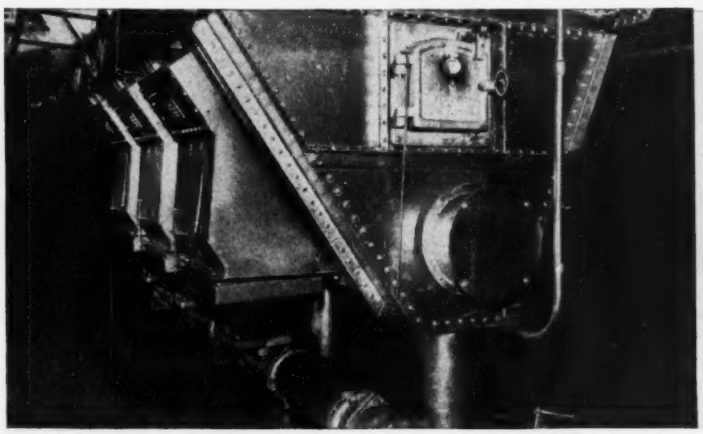
YOU SAVE IN BUILDING COSTS

For a given steam capacity and furnace width, over-all height of the unit is reduced by at least five feet resulting in large savings in building cost if new building is involved or permitting installation or larger capacity units in existing building.

SPONTANEOUS ACCEPTANCE BY ENGINEERS

Thirty-five of the country's leading consulting engineering companies have engineered boiler installations involving Riley units of this type. Engineers have selected this type of unit for over 85% of all Riley pulverized coal-fired installations, purchased since 1948.

Photo below shows Hopper Construction and Ash Conveying System.



Since the first Riley unit of this type was installed in 1946, 137 units have been sold having a steam generating capacity of over 20,000,000 lbs. per hour.

These users have expressed their satisfaction by placing repeat orders with Riley.

Hooker Electrochemical Co.
Celanese Corporation of America
United States Steel Co.
Monsanto Chemical Co.
Esso Standard Oil Co.
Pratt & Whitney Aircraft Corp.
City of Holyoke
Syracuse University
Central Ohio Light & Power Co.
Western Colorado Power Co.
Riegel Textile Co.
Northern Paper Mills
City of Rochester, Minnesota
Cities Service Oil Co.
Dairyland Power Cooperative
Ohio Oil Co.

Other Users

Carbide & Carbon Chemical Co.
Western Electric Co.
Carrier Corporation
Continental Can Co.
South Carolina Electric & Gas Co.
United States Rubber Co.
North American Aviation
General Electric Co.
Goodyear Tire & Rubber Co.
Flintkote Co.
Norton Company
Thomas A. Edison Co.
Colorado Fuel & Iron Co.
White Pine Copper Co.
Chase Brass & Copper Co.
Hanna Furnace Corp.
Calumet & Hecla Consol. Mining Co.
C. H. Masland & Sons
American Viscose Co.
Great Lakes Steel Co.
Bird & Son, Inc.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

NOW...

1. THE LINE-UP . . . After precision positioning of butts the joint is tack welded to hold in place during the welding of the initial bead by the K-Weld process. This new technique entails the use of an inert gas under controlled pressure on the inside of the piping.

2. INITIAL BEAD IN K-WELD . . . Only the initial bead is laid by the K-Weld process. It eliminates the need for a backing ring, permits the complete penetration required for critical high-pressure, high-temperature power piping being installed today.

3. FIRST INSPECTION . . . Either Zyglo or X-ray can be used to inspect the K-Weld bead. Elimination of the backing ring removes the stress raising condition at the weld root which can produce flaws either as a result of thermal effects of subsequent weld layers or later severe operating conditions.

Done with mirrors... A conventional telescopic bore-sight plus a mirror positioned at the weld permits visual inspection of the K-Weld root. Note smoothness and absence of any icicles which might create local turbulence or break off and damage equipment.

..K-WELD

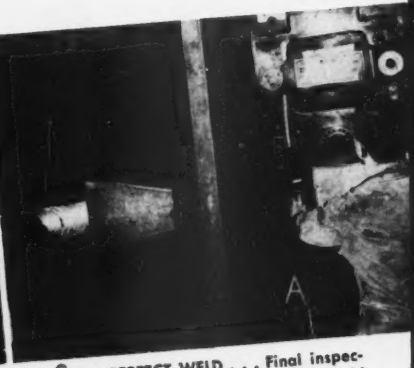
a picture story of the new welding technique that...

- **assures complete penetration without backing rings**
- **applies to all power piping materials**
- **for use in shop and field fabrication**

From rockets to power piping is largely the story of Kellogg's new K-Weld process, a welding technique that assures a sound root weld in the fabrication of piping. It stems from Kellogg's initial work in the production of thin-wall rockets where shielded-arc welding is a requirement in fabricating stainless steel rocket tubes. How this technique has been developed and extended to the fabrication of critical high-temperature, high-pressure piping is detailed in the accompanying picture story.

4. COMPLETING THE WELD . . . Conventional shielded metallic arc welding is employed to complete the weld which can be done by any competent welder qualified for this class of work.

5. STRESS RELIEVING . . . The completed weld after grinding is ready for heat treatment in the customary manner. An additional advantage of K-Weld is that elimination of the backing ring materially aids in the interpretation of radiographs.



6. A PERFECT WELD . . . Final inspection is made of the weld. Here K-Weld has been proved to be extremely useful in eliminating the root cracking associated with austenitic welding . . . providing a completely satisfactory weld.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING . . .

- Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
- Hydro-Electric Power Commission of Ontario (Canada)
- Indiana & Michigan Electric Co.
- Interbrabant (Belgium)
- Long Island Lighting Co.
- Metropolitan Edison Co.
- Mexican Light & Power Co. (Mexico)
- Monongahela Power Co.
- New York State Electric & Gas Company

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For further information, details of methods, etc. contact

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

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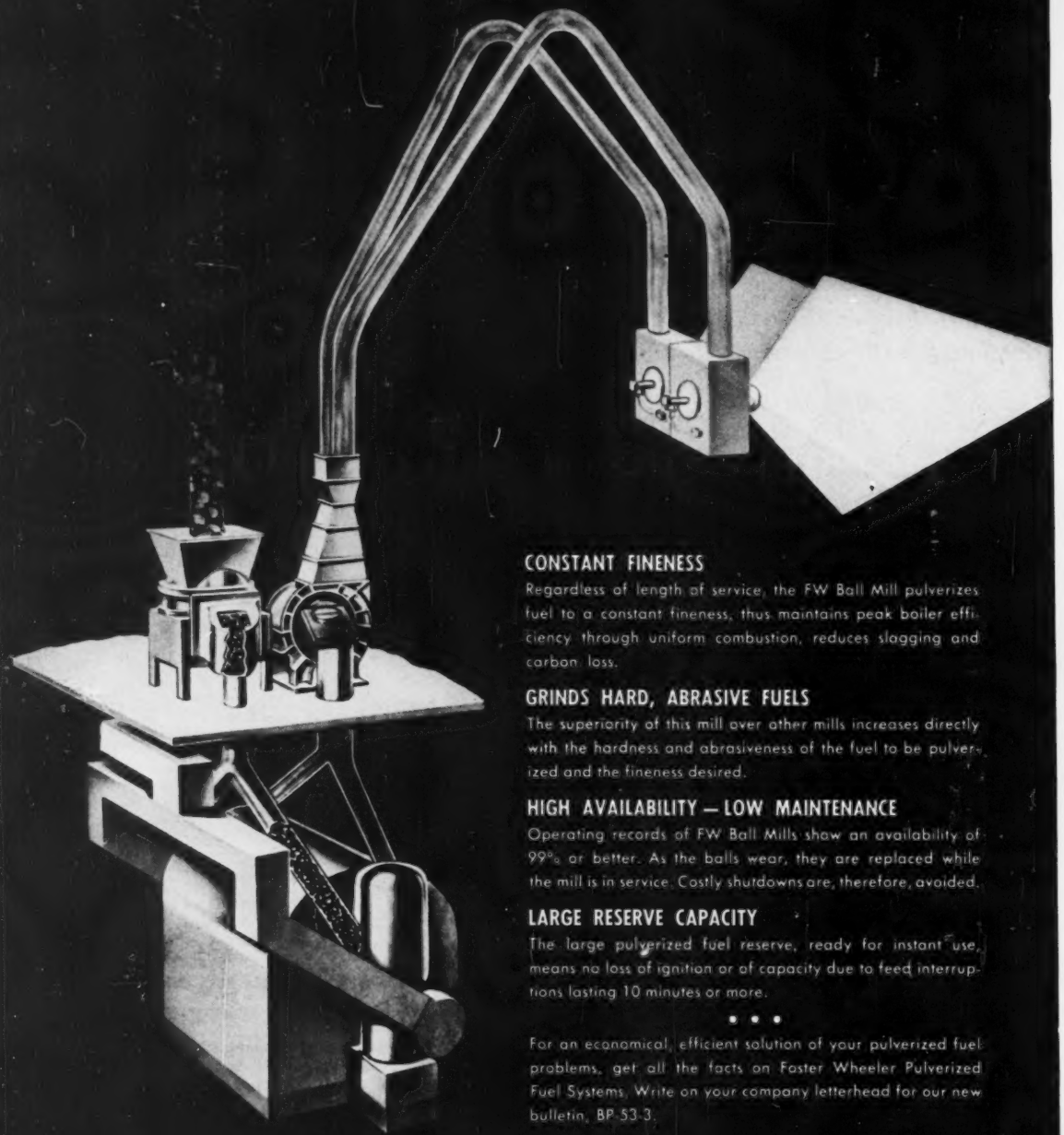
HIGH PRESSURE

POWER PIPING

Only FW PULVERIZED FUEL SYSTEMS
bring you all 4 important advantages



CONSTANT FINENESS
Regardless of length of service, the FW Ball Mill pulverizes fuel to a constant fineness, thus maintains peak boiler efficiency through uniform combustion, reduces slagging and carbon loss.

GRINDS HARD, ABRASIVE FUELS
The superiority of this mill over other mills increases directly with the hardness and abrasiveness of the fuel to be pulverized and the fineness desired.

HIGH AVAILABILITY — LOW MAINTENANCE
Operating records of FW Ball Mills show an availability of 99% or better. As the balls wear, they are replaced while the mill is in service. Costly shutdowns are, therefore, avoided.

LARGE RESERVE CAPACITY
The large pulverized fuel reserve, ready for instant use, means no loss of ignition or of capacity due to feed interruptions lasting 10 minutes or more.

• • •

For an economical, efficient solution of your pulverized fuel problems, get all the facts on Foster Wheeler Pulverized Fuel Systems. Write on your company letterhead for our new bulletin, BP-53-3.

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FOSTER WHEELER

ANACONDA FORUM
for the Electrical Industry

MODERNIZATION AND ELECTRIFICATION— A LOOK AHEAD

by: Maxwell Cole
Manager Market Studies and Service Division
Philadelphia Electric Company
Philadelphia, Pa.

AMERICAN industry, its vision of new products for better living, its ingenuity in developing new methods and materials to make them, and its courage to invest in the facilities to produce them is the cornerstone on which American living standards have been erected. To make more things, faster, better and cheaper so that they may be available to more and more people has been the goal of American industry. Its success in reaching toward that goal has been its outstanding accomplishment.

REPLACING MANPOWER WITH HORSEPOWER

Operating in a free competitive economy, at liberty to develop new products and better ways of making them, American industry has taken full advantage of the opportunities offered by modern, high speed tools powered by electricity to increase its productive capacity, to improve its product and to reduce costs by replacing manpower with horsepower. Refrigerators and washing machines, automobiles and jet-propelled planes, plastics and stainless steel and many other of today's conveniences, even necessities, would not be available in sufficient quantity or at low enough prices to have become accepted elements of American life but for the readiness of industry to accept new products and new methods and to modernize their facilities to accommodate them. Industry's readiness to streamline production methods and modernize facilities enabled us to snow our enemies of World War II under an avalanche of production.

NEW CHALLENGES

Today, industry faces new challenges. It must produce materials of war in such quantity and of such quality that no enemy dare attack us; it must maintain progress in fields of civilian production; and many people believe we are entering an era of keener competition than experienced for many years. Industry's ability to meet these challenges depends on its willingness to continue to modernize facilities and keep abreast of progress.

CONTINUED MODERNIZATION LIES AHEAD

We stand only on the threshold of the promises science and industry hold out for our future strides into security and better living. These promises will become realities only as better, more powerful tools are developed for producing them and as industry maintains its courage in investing in them to continue our national progress and replace wasteful or obsolete methods. Contemplating such a vista of promises, with faith that American industry still possesses characteristics which raised it to its present level of greatness, one foresees continued modernization of American factories, processes and products at a pace even greater than it has been in the past.

AMERICA'S CHALLENGE to industry is to meet and sustain an increasingly higher level of production in the face of keen competition. New and better equipment—such as this installation of a 75,000-pound chain drawbench in a Connecticut Mill—is a vital part of expansion and modernization. With each new machine comes the need for increased power and modern wire and cable!

A LOOK AT MODERN

It was great sport but . . .

EVER SEE A STUTZ "BEARCAT" on the road these days? With loving care and a knack for tinkering, hobbyists still keep a few going. They are good cars . . . but hardly economical modern transportation. Now consider how much antique wiring lies around still doing a job . . . of sorts. Hardly efficient. Pathetically unprofitable when pitted against modern power needs. What are we going to do about it? The following article gives some good reasons for re-evaluating our requirements for reserve capacity and replacing obsolete wiring . . . with new and better products.

ONCE MORE it's a case of growing pains! Today industry has already used up its power reserves—though these were considered adequate ten years ago. Now it's time for another upward revision of our ideas of what is a sufficient power margin for operating the new production tools that have been put in our hands. To power them, utilities are now in the process of re-doubling their load capacity. Our stepped-up rate of production and consumption has telescoped the future . . . even beyond the soberly considered estimates of industry leaders as recently as a decade ago!

The link between tool and power source is wiring. New tasks suggest new techniques . . . new tools . . . new power loads . . . new wiring to carry the load. Yesterday's wiring may bottleneck today's production flow.

Some existing plants haven't spotlighted their wiring in many a year. Now—with new production factors in the picture—it is time for a basic survey of wiring. If it's obsolete, replace it . . . and reap the benefits of more efficient power, greater reliability, and long-range economy.

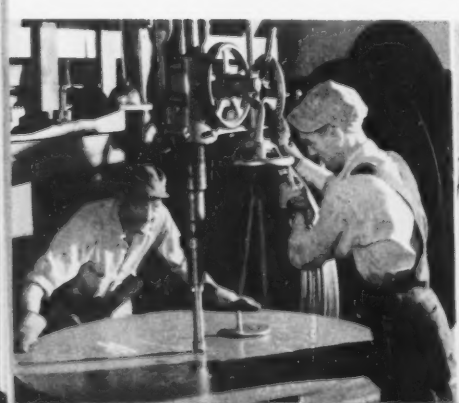
Modern wiring has seen a wealth of new developments—especially in insulation. Let's take a quick look at what's been done. It's all interesting, practical and valuable.

RUBBER INSULATION

Modern wiring may be defined as that approved and accepted since World War II. Twenty years ago we spoke of "enormous strides" in such things as rubber compounding. These resulted in superior products. We

ANACONDA was the first manufacturer of wire and cable to use synthetic resin compounds for insulation. One example is DENSHEATH*—a high-grade and super-aging thermoplastic (vinyl resin). This is widely used today for wiring on (1) machine tools, (2) appliances, and (3) various types of signal systems—as well as for control or switchboard, building or general purpose wiring.

*Reg. U.S. Pat. Off.



DEVELOPMENTS IN WIRING INSULATION

ARE WE ASKING OBSOLETE WIRING TO DO TODAY'S NEW JOBS?

can still speak of "progress." There has been lots of it. They are still striding forward—the chemists, metallurgists, cable engineers and their co-workers. The end is not in sight.

Heat is the great enemy of electrical insulation. But today Code Rubber, Type R, does a much better job in withstanding heat than a few years ago. TABLE I shows how this and other rubber compounds compare.

KIND OF INSULATION	MAXIMUM ALLOWABLE CONDUCTOR TEMPERATURE		
	1940	1947	1953
	degrees C		
Code, Type R	50	60	60
Type RW	50	60	60
Type RH	75	75	75
Type RH-RW	—	—	75,60**
Heat- and moisture-resistant	60,70,75	75,80	75,80
Ozone-resistant* (ASTM oil base)	70	70,75	70,75
Ozone-resistant* (butyl)	70,75	75,80	80,85

*Temperature varies with manufacturer
**whether in dry or moist location

TABLE I

Type RH-RW is outstanding. This is being used so much now—at little more cost than Type R—that the latter has a narrower market than even just after the war. Ozone-resistant, butyl-base compound is another excellent performer. Its stability, long aging, low power factor and other desirable physical and electrical properties under severe operating conditions make it a dependable compound for voltages up to 15 kv and sometimes higher. Several manufacturers supply it.

During World War II natural rubber was out. Synthetic (G-RS) rubber took its place. In just a few years, cable manufacturers found many things in its favor . . . so many, in fact, that the natural product is disappearing as a wire and cable insulation. "Cold" rubber is another development. Coming fast into regular use, it brings improved physical and electrical properties to low-voltage cables.

B-r-r-r . . . now I'm cold!

Another forward stride is the pre-war development and post-war application, in great quantity, of neoprene jacketing for rubber-insulated cable. Dependable under many severe conditions, relatively inexpensive, it is excellent in moist or dry conduit, direct burial, in aerial and other locations.

THERMOPLASTIC INSULATION

You can do a modern wiring job today with materials barely existing or unknown as late as just before World War II. These are the thermoplastics. Two stand out as basic insulations: polyvinyl chloride (vinyl resin and one or more of its co-polymers, which appear under various trade names) and polyethylene.

Polyethylene is a remarkable insulation for many purposes. It made radar possible. Now, however, the real workhorse of the industry is the first—PVC for short.

Millions of feet of PVC are used annually for wiring houses, stores, office buildings, by the armed forces and in many industrial applications. It resists many enemies of insulation: oil, moisture, acids, alkalies, abrasion, greases, and gasoline. With just normal treatment, it has a long life.

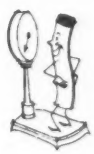
There are many other thermoplastics; the list has grown long in just a few years. But only a few others are used for insulations. Among them are Rulan, Nylon, Cardolite, Saran, Tenite II, Styraloy, and Teflon.

Polyethylene has a very high dielectric strength, low power factor and low moisture absorption when compared to vinyl resin. The latter has lower dielectric strength, high dielectric loss, and satisfactory moisture resistance. Vinyl resin resists ozone. Polyethylene is immune to it. This indicates why polyethylene can be used for high-voltage and high-frequency circuits while vinyl resin, which is cheaper, does very well on low voltages. Both have a weakness. They become plastic at comparatively low temperatures. High overloads on these types of conductors must be guarded against. TABLE II lists some comparative values.

Kind of Insulation	Code Type	Application	Maximum Allowable Conductor Temperature and Location (degrees C)
vinyl resin	T	general purpose	60 dry locations
vinyl resin	TW	general purpose	60 moist locations
vinyl resin	—	machine tool control and switchboard	60 in oil 80 in air
vinyl resin	—	appliance wiring	80,90, or 105 in air only*
Polyethylene	—	general purpose	80 usually special

*depending on compound used

TABLE II



"Thermoplastics help me reduce."

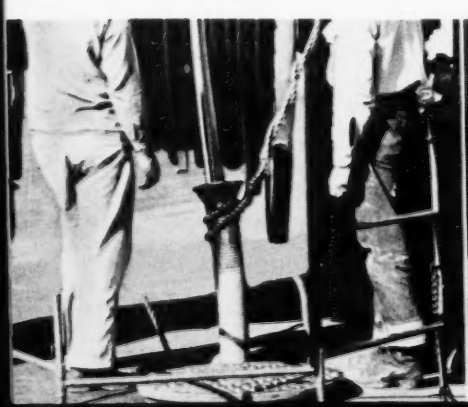
Logically thermoplastics replace rubber insulations for some applications—but not for all. In building wire one outstanding property of thermoplastics is toughness. They require no protective braid. Hence, wire so insulated takes less space.

* * *

This article provides only a brief sketch of a fascinating field. Lower operating costs from more efficient power distribution influence plant profits. In the light of developments discussed here, many readers may want to re-evaluate their own wiring. It's a timely undertaking. We suggest that for more details you write to, or consult with, individual manufacturers.

DURASHEATH* neoprene-jacketed cable has ANACONDA Type ANW (cold-rubber) or Type AB (ozone and heat-resistant butyl) insulation, depending on voltage rating. Used for (1) distribution networks and where wet ducts may contain acid or alkali waters, (2) industrial power distribution overhead, in direct burial, or conduit, (3) circuits in conduit—and many other applications.

*Reg. U.S. Pat. Off.



If you want to cut equipment-relocation costs . . .

WIRE MACHINES TO MAKE THEM MOVABLE

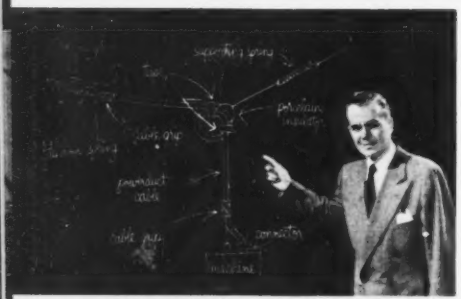
Basic industry strategy calls for more productive machine power. Look into plants like those of the automobile makers. There large banks of automatic machines are lined up in close array. They turn out parts. One bank may occupy only a small part of the long, huge floor area required.

MACHINES SOMETIMES MOVED

Each machine needs a cable. Offhand it seems easy to get cable to machine. But actually some ingenuity is needed to avoid excessive installation costs. The situation is aggravated by the chance that next year —or next month—all machines must be moved in accordance with model changes or plant efficiency.

BUS AND BUSDROP CABLE

You can solve the whole problem very neatly. First install a busduct system on ceiling or under roof trusses. Then connect each machine to it with a flexible cable carrying power and grounding conductors. This cable is called "busdrop cable."

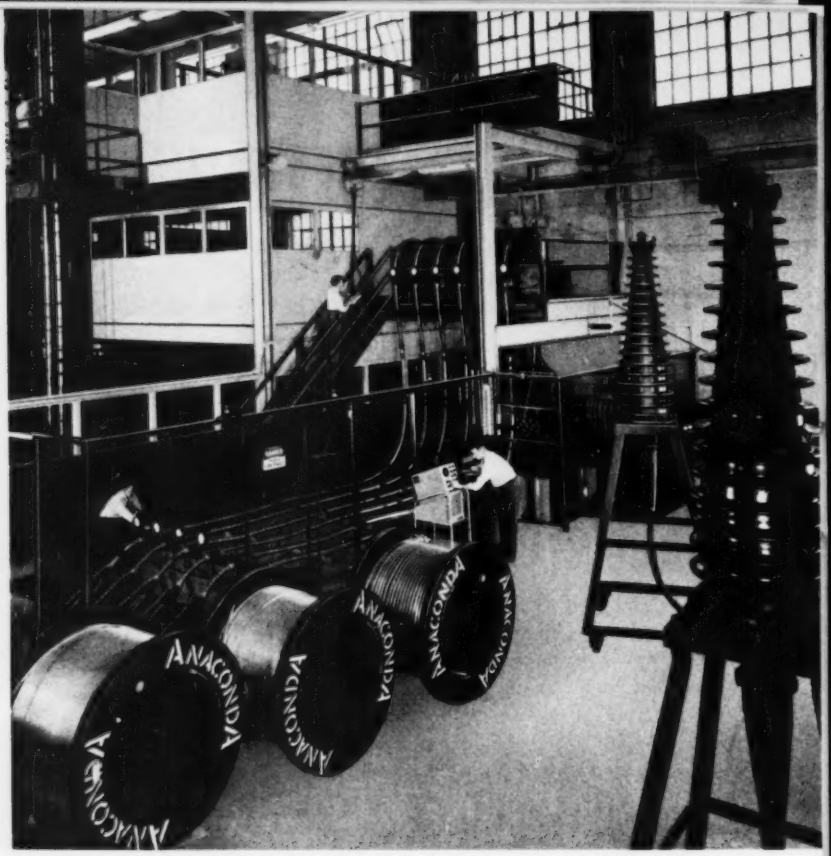


IT'S EASY to plug in your machine with flexible busdrop cable. There's no rigid conduit to rip out later.

TAILOR-MADE SYSTEM

Busduct Power Distribution Systems are widely used. They may be bought tailored to any plant's needs. They are economical; cable can be disconnected and reused elsewhere. This is done often. It means real flexibility, saves time and maintenance costs. It helps industry to keep up its high pace of production.

To do its job right, to last long and to stay neat, busdrop cable must be able to take heavy mechanical abuse and must handle easily. It must be impervious to oils, acids, water, greases, and cutting compounds. And, of course, it's always wise to look for approval from Underwriters' Laboratories, Inc. 53384



LAB THAT HURRIES TIME

. . . CUTS YEARS TO MONTHS IN TESTS TO GIVE YOU LONGER-LASTING CABLES

In this Cyclic-Aging Laboratory at Hastings-on-Hudson, N. Y., high-voltage insulated cables race through the calendar. Once the valuable data which cable-aging made available to electrical engineers took decades to accumulate in actual service—often 20 to 50 years. But here a lifetime of experience is gained in a few years. Rigorous 24-hour test cycles simulate actual conditions . . . but are much more severe. Anaconda Engineers get vital data on cable life, stability and other characteristics needed to evaluate cable design.

This is typical of Anaconda planning—geared to the future. It is only a part, however, of a company-wide program of expansion and improvement now nearing completion in mills and mines. Net result: better cables, available in larger quantities, that last longer and give you *true* economy in use *when you specify* ANACONDA.

FOR FURTHER INFORMATION about any product mentioned in the pages of this advertisement, see your Anaconda Representative . . . or write to *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

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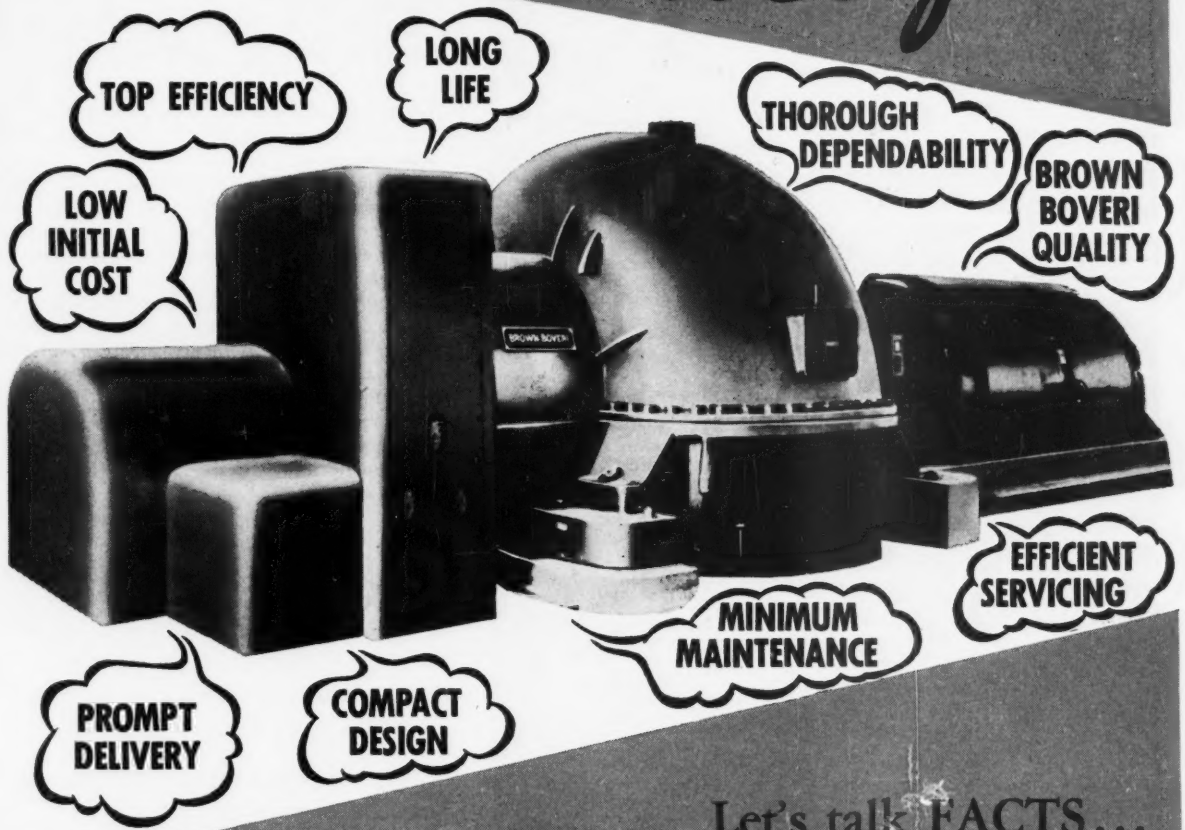

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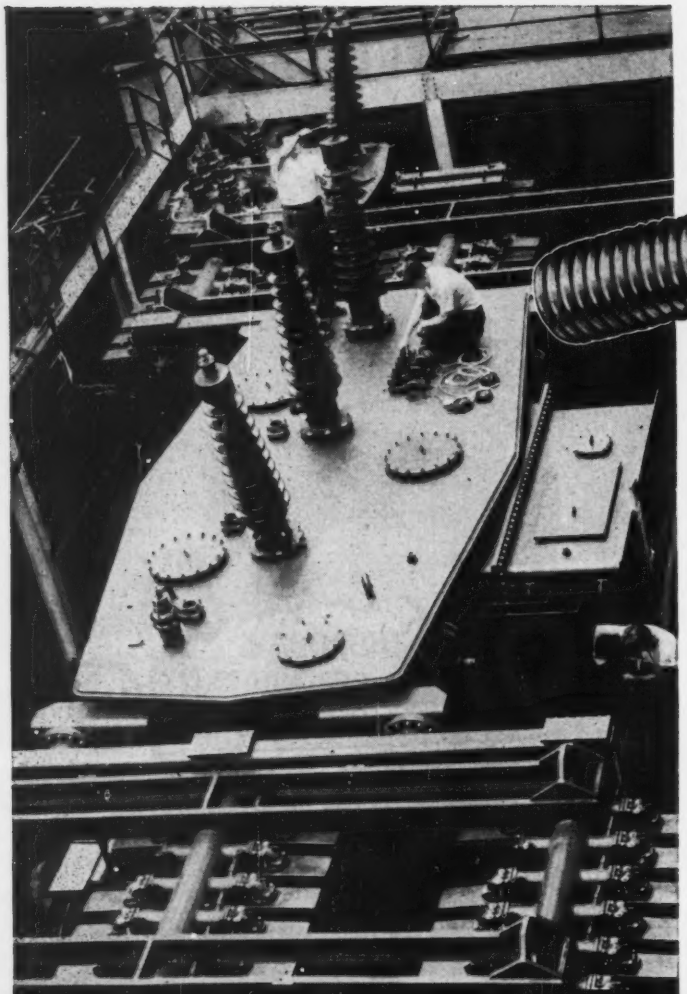

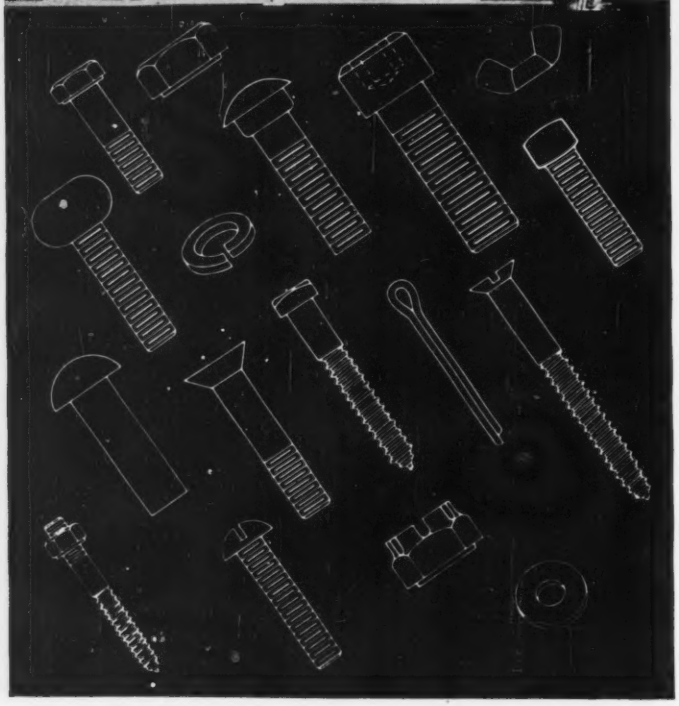

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2500 Kva, 3 Phase, 60 Cycles,
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Manufacturers of Load Ratio Control Equipment have long concentrated their attention on designing a snap action tap changer mechanism that would operate quietly.

Pennsylvania tackled this problem a number of years ago and in 1949 perfected the *Silent Snap Switch.* Millions of "in the field" operations have verified its sound design principles and fine construction.

The Silent Snap Switch moves swiftly and quietly in response to the demands of the automatic control mechanism. Voltages are raised or lowered in comparative silence.

High among the advantages of quiet tap changing operation are the following:

1. less wear and tear on the equipment;
2. no breakdowns from mechanical impact;
3. longer and more satisfactory tap changing mechanism life.

Quiet Load Ratio Control transformers are especially desirable for installation in residential areas where undue noise, and the clanging and banging formerly associated with the operation of underload tap changing equipment are extremely objectionable.

Pennsylvania Load Ratio Control transformers with the Silent Snap tap changing action are available in sizes up to 7500 Kva and in all voltages.

For complete information, write Pennsylvania Transformer Company, Canonsburg, Pa., and ask for Catalog 5112.

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who is he?

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in large industry, or he might be a consulting electrical engineer
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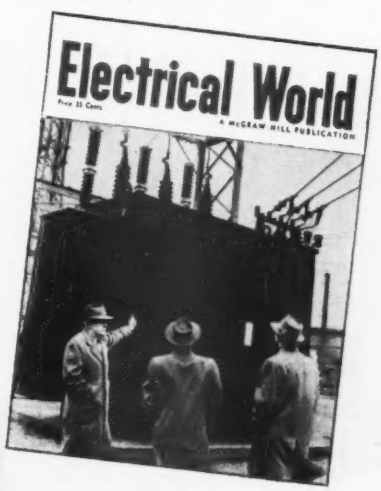

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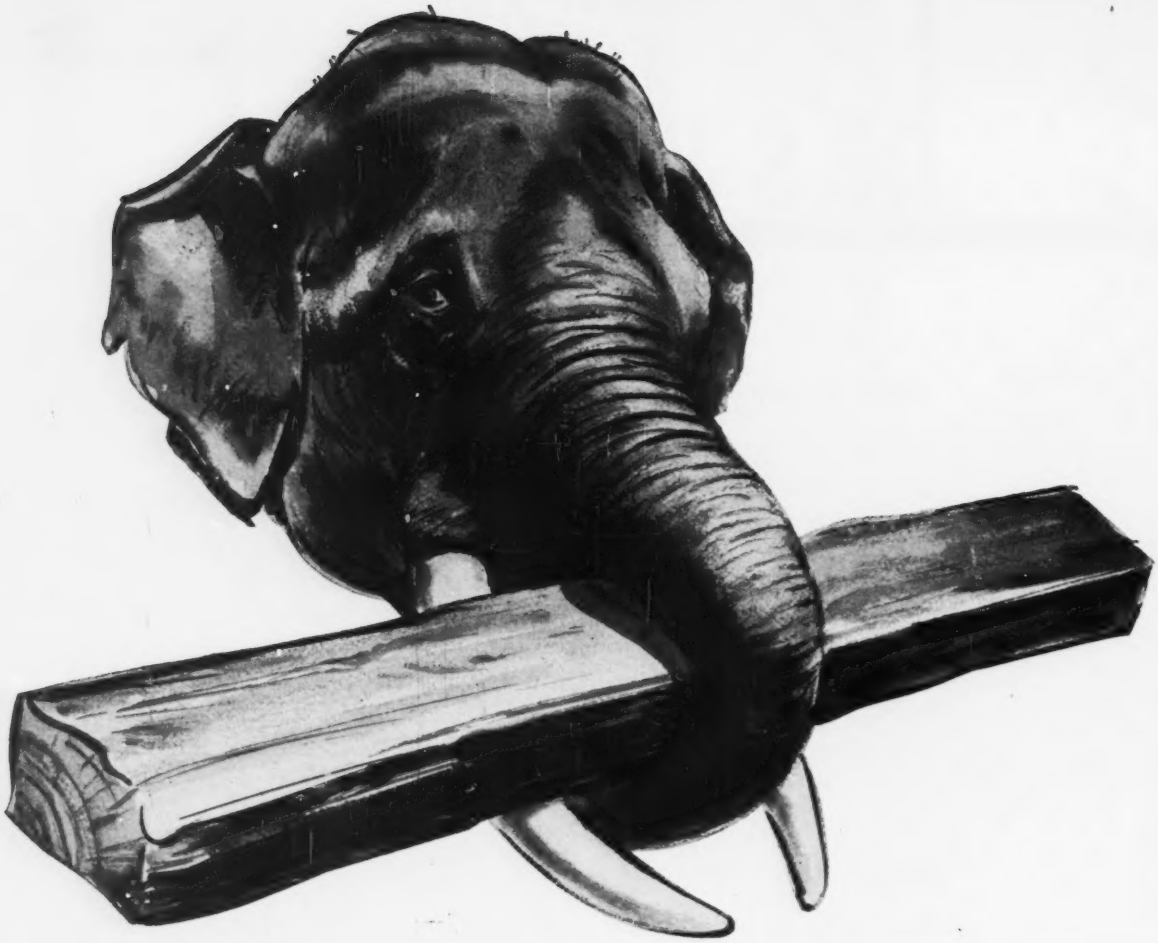
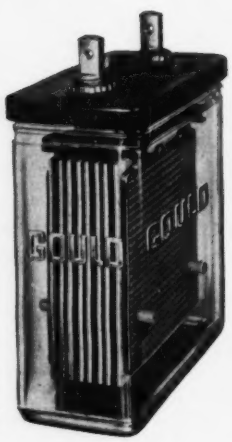


RESERVE STRENGTH For Emergencies

THANKS TO BATTERY POWER!

All standby batteries are *not* alike. Gould Planté is different. It is the only battery available today with positive plates of pure lead—plates that enable the battery to renew itself as it floats. Whether you need a powerful surge or a steady flow, Gould Planté has abundant power in reserve, ready for emergencies today, tomorrow or years from now.



Specify
THE GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

GOULD *INDUSTRIAL BATTERIES*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

©1953 Gould-National Batteries, Inc.

TO YOU-

The most important Step of All

The Trade Mark of Top Quality

TRIANGLE
IT MUST BE RIGHT!

The name behind the product can mean much to you. If you like to deal with a company that puts cooperation, friendliness and integrity above all—remember—

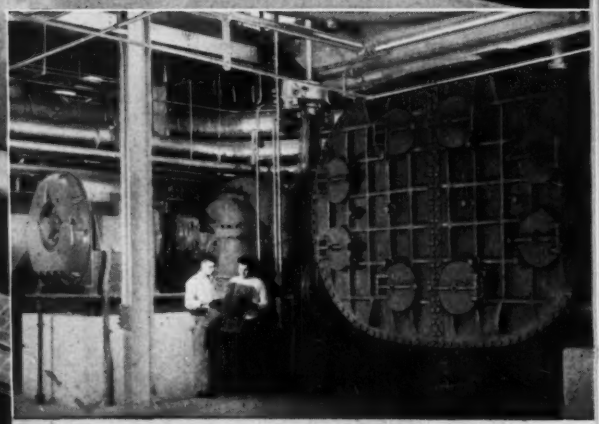
You'll like doing business with Triangle — and with Triangle distributors.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, N. J. • MOUNDSVILLE, W. VA.

When it's a Question of Carrying Electrical Power—Specify **TRIANGLE**

THE CONDENSER THAT CUTS



Two views of 30,000 sq ft condenser serving A-C 40,000-kw turbine in southern power plant. Inset also shows A-C circulating water pump and motor.

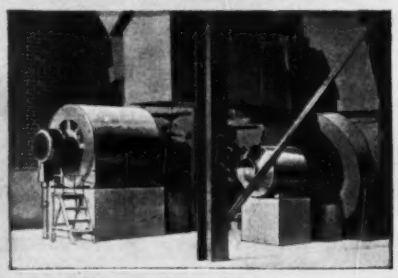
Equipment for Power: Water Conditioning equipment, chemicals and service . . . Steam and Hydraulic Turbines . . . Generators . . . Condensers . . . Steam Jet Air Ejectors . . . Power Plant Pumps and Motors . . . Transformers . . . Circuit Breakers . . . Switchboards and Control . . . Switchgear . . . Unit Substations . . . Utilization equipment.

ALLIS-

IT PAYS TO KEEP PACE WITH MACHINERY PROGRESS

Motors That Are at Home Outdoors

Open sky is roof enough for Allis-Chalmers *tube-type* totally-enclosed fan-cooled motors. Tube-type air-to-air heat exchanger construction makes large ratings practical. Time-proved design is practically self-cleaning, cuts maintenance costs.



POWER COSTS

3 WAYS

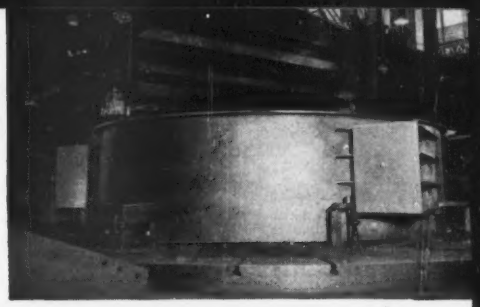
WITHOUT SURFACE CONDENSERS, low-cost steam-generated electric power would not exist. By maintaining a vacuum at the turbine exhaust, condensers increase plant efficiency and power output. By condensing steam for reuse, they minimize feedwater requirements and costs.

In installation after installation, Allis-Chalmers condensers have given outstanding performance. They are tailor-made for each particular installation. They incorporate design features that provide continuous unbroken operation. And they have consistently cut power costs by maintaining:

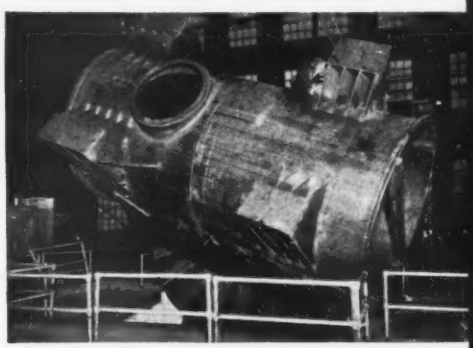
1. **Lowest practical absolute pressure obtainable with the water temperature available.**
2. **Highest "terminal-difference" efficiency; that is, the temperature of the cooling water leaving the system most nearly approaches the temperature of the steam in the condenser.**
3. **Highest possible condensate temperature.**

The engineering behind these cost-cutting, multi-steam-path condensers results from more than 60 years of condenser building experience. Since the days of the early steam engines, Allis-Chalmers has produced more than 13,000,000 sq ft of condenser capacity — for all areas of the country and for all types of water conditions.

Whether you need a 500 sq ft or a 100,000 sq ft condenser, you can benefit from this experience — and from A-C's unexcelled manufacturing facilities. Why not discuss your requirements with your nearby A-C representative. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3813



Adequate manufacturing facilities assure accurate machining and assembly. Here, a 40-ft mill easily handles end section of a 75,000 sq ft condenser.



Special welding positioner produces sound welds by permitting operator to work in natural position.

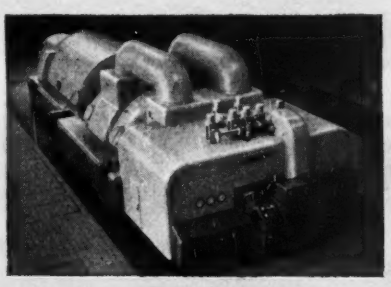
Drilling bolt holes in flange of large oval shell section requires modern facilities so parts will fit precisely.

CHALMERS A-C ALLIS-CHALMERS

Ask your A-C representative for Bulletin 1986784, which shows how Allis-Chalmers builds these cost-cutting condensers.

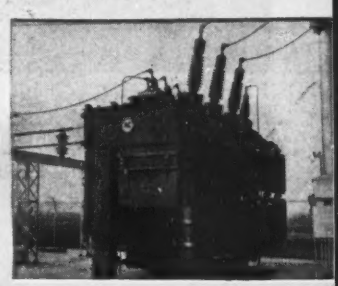
First Generator with Supercharged Cooling

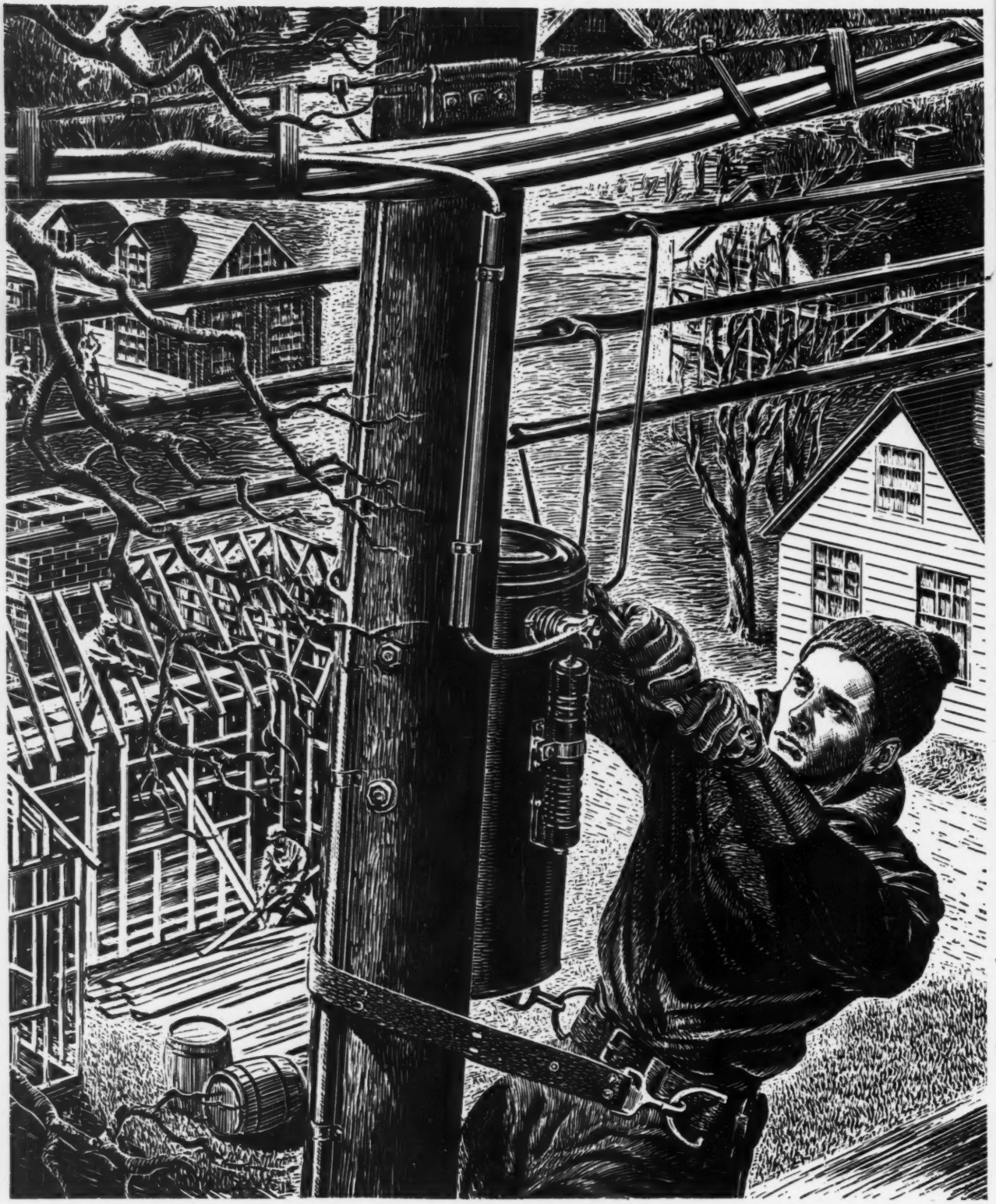
In this operation-proved turbine-generator, *supercharged* hydrogen passes through rotor conductors. *Supercharging* increases output per unit size . . . cuts foundation costs, plant size, and breaker and bus structure requirements.



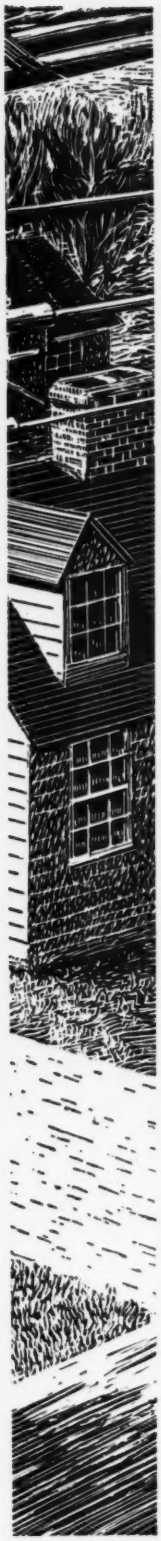
Transformers with Corona-free Design

To check insulation aging, A-C transformers are designed to be corona-free even at highest test voltages. Without corona, your transformers stay young; repeated voltage stresses do not cause progressive deterioration of insulation.





When electric utilities install G-E Super Coronol cable they obtain extra capacity compared to older-type rubber-insulated cables. Moreover, because the normal rating of Super Coronol cable has been raised twice since it was first introduced, those electric utilities who installed it before 1952 can obtain extra capacity without extra cost.



Early users bought this cable on the basis of longer life... Now they find

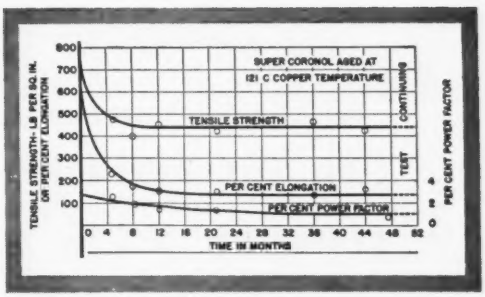
G-E Super Coronol Cable offers them Extra Capacity Without Extra Cost

Power companies that bought G-E Super Coronol* cable when it was first introduced can now handle as much as 12% more power with the cable than its original rating permitted. In many cases this means that additional cables or new ducts are not required to provide for increased power demands. Here is why:

In 1944, General Electric announced a radically improved cable, later called Super Coronol, that had exceptional resistance to almost all cable-destroying elements. It was rated 75 C copper temperature—as were other heat-resistant rubber-type cables. Also the new cable was largely impervious to the effects of heat, acids, ozone, and most other factors that shorten cable life. It was for these reasons of indicated long-life that electric utilities first purchased this new cable.

Two years later, G.E. raised the temperature rating of this new Super Coronol cable to 80 C. This was news. It was the highest rating ever announced for a rubber-type cable. Early users could add up to 6% more load to existing Super Coronol cable circuits with little or no effect on cable life. Then last year General Electric again raised the rating of Super Coronol cable—this time to 85 C copper temperature for 0-8000 volts thus permitting another 6% boost in load.

*Registered Trade-mark General Electric Company



This curve shows the results of aging tests on Super Coronol cable to date. The tests are being continued. Note that these results were obtained at a copper temperature of 121 C. This test, and others like it, formed the basis for increasing the cable's normal rating. The ample factor of safety is obvious.

Although increased ratings of these magnitudes cannot always be obtained, you *can* expect wire and cable from General Electric to incorporate the latest achievements of research in insulation and the economies of efficient manufacturing. It will pay you to call in your G-E Wire and Cable specialist whenever you have a cable problem. Or write for Super Coronol power cable booklet. Section W59-727, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC

SPLICE or DEADEND STEEL STRAND

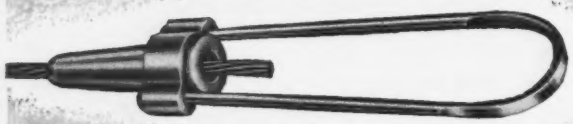
in seconds without tools

Reliable

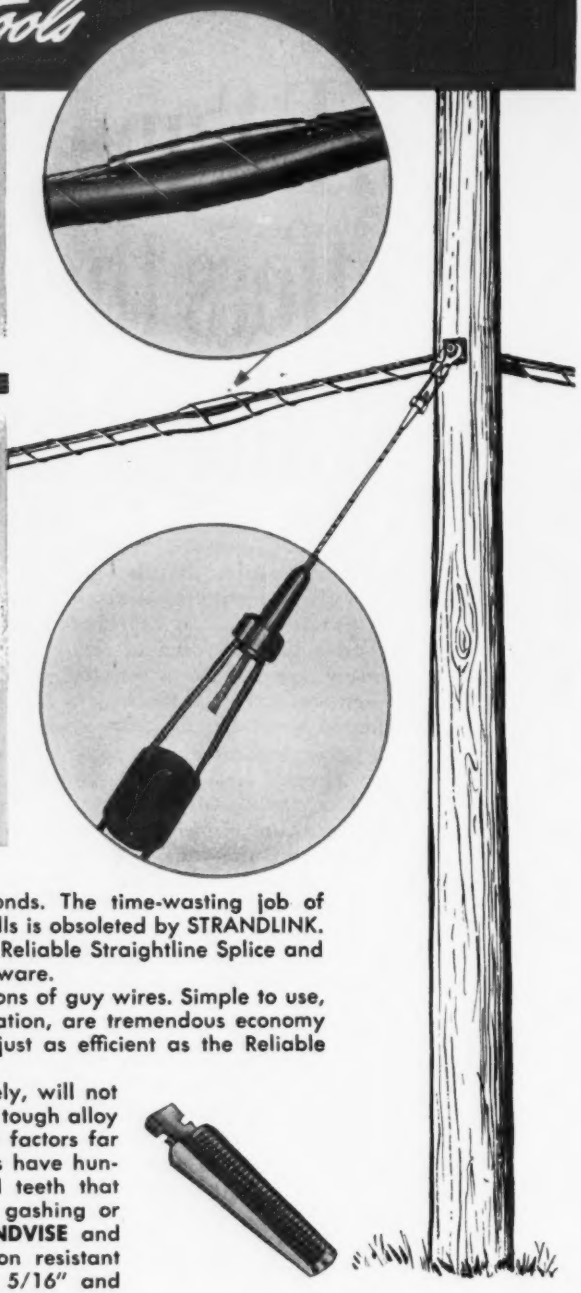
STRANDLINK

or

STRANDVISE



can cut installation time by 90%



STRANDLINK splices messenger wire in seconds. The time-wasting job of handling nuts, bolts, hardware and johnny balls is obsoleted by STRANDLINK. STRANDLINK is used just like the well known Reliable Straightline Splice and costs far less than conventional splicing hardware.

STRANDVISE finds its greatest use in installations of guy wires. Simple to use, the time and wire saved, especially on relocation, are tremendous economy factors. STRANDVISE is just as easy to use, just as efficient as the Reliable Straight-thru Deadend.

Both **STRANDLINK and STRANDVISE** grip surely, will not slip. The cartridges of heat treated aluminum, tough alloy yokes, and stainless steel bails have strength factors far beyond that of the strand. The gripping jaws have hundreds of case-hardened, Zinolite-plated steel teeth that grip sharply, hold permanently yet without gashing or exposing bare steel of strand. Every **STRANDVISE** and **STRANDLINK** is factory treated with corrosion resistant lubricant for protection. Available in 3/8", 5/16" and 1/4" sizes.

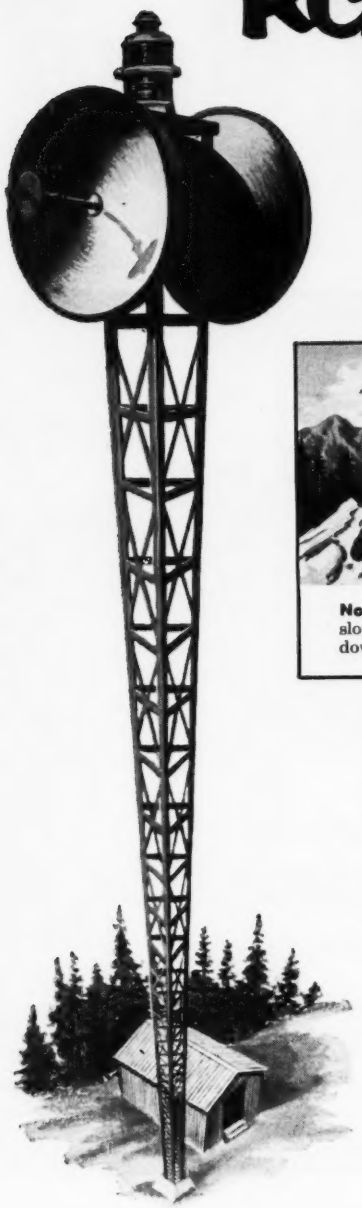
Reliable **ELECTRIC COMPANY**

3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

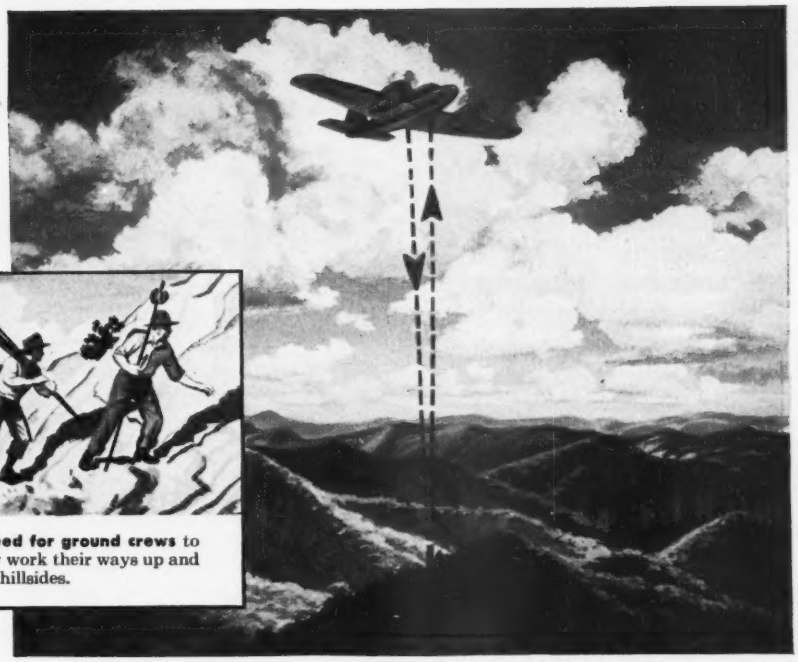
OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

RCA MICROWAVE



No need for ground crews to slowly work their ways up and down hillsides.



Radar signals provide precise data on contour of earth beneath proposed path of a microwave beam.

RCA AERIAL SURVEY
speeds installation ... insures accuracy

For the ultimate in microwave planning, RCA offers the important advantages of fast, accurate aerial survey.

Flying a simulated path of the microwave beam, ground elevations are charted by continuous readings from a vertical radar system. Recording instrumentation enables the survey team to plot an accurate route—and an *alternate route*—at high speed. By direct observation and aerial photography these experts select the most economical, easily accessible sites. An unobstructed microwave route is plotted in a fraction of the time normally required—without the premature publicity that often results from surveyors' operations.

For dependable communication, proved on existing systems, call an RCA Microwave Specialist at the nearest Regional Office, or MAIL COUPON.

• • •

Check RCA 2-way radio for proved dependability in mobile communications.

And remember, only RCA can provide the nationwide service facilities of the RCA Service Company.

RADIO CORPORATION of AMERICA
COMMUNICATIONS DIVISION **CAMDEN, N. J.**

Communications Division
Radio Corporation of America
Dept. 45 ɔB, Building 15-1
Camden, N. J.
Please send me your free booklet on:

- ☐ RCA Microwave
- ☐ RCA 2-Way Radio
- ☐ Send an RCA Communications Specialist

Name_____

Title_____ Company_____

Address_____

City_____ Zone____ State_____

NEW UTILITY STATIONS C-E EQUIPPED

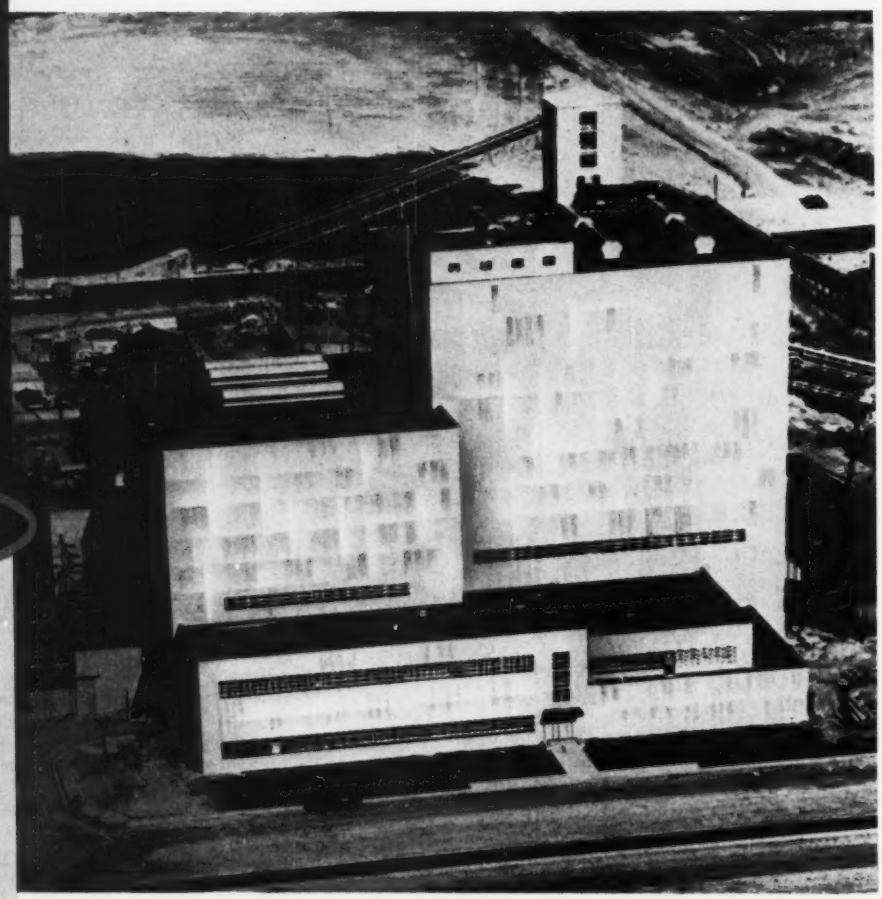
Includes stations placed in operation since the war (in white) and those under construction or being engineered.

New

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC

PORTSMOUTH

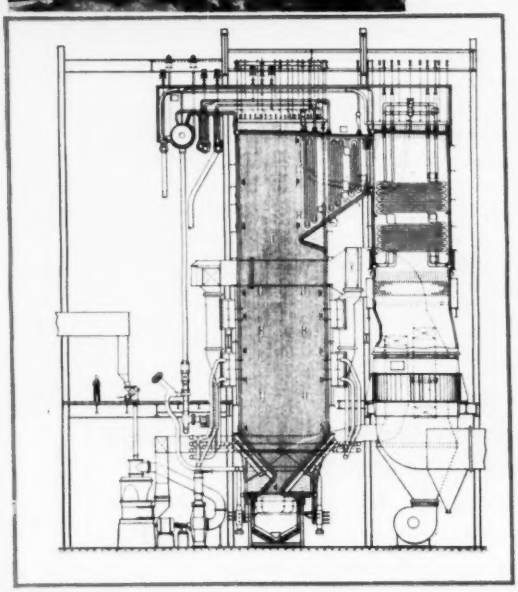
LAKE CREEK
ETIWANDA
HENNEPIN
URQUHART
EASTLAKE
OAK CREEK
AURORA
KINGSTON
BARRY
SUWANNEE RIVER
NELSON
SAGUARO
SANDOW
MULLERGREN
WILMINGTON
MILLIKEN
JOHN SEVIER
VERMILION
GALLATIN
ISLAND PARK



The cross-sectional view at the right shows one of the two C-E Units which comprise the first section of the new Portsmouth Station of the Virginia Electric and Power Company. These units are of the controlled-circulation, radiant, reheat type with the reheater section located between the primary and secondary superheater surfaces. An economizer section is located below the rear superheater section and regenerative type air heaters follow the economizer surface. Each boiler serves a 100,000 kw turbine-generator operating at a throttle pressure of 1450 psi with a primary steam temperature of 1000 F, reheated to 1000 F. The unit will burn pulverized coal employing bowl mills and tilting, tangential burners; there is provision to use oil as an alternate fuel.

Portsmouth Station

GOES INTO SERVICE



The first unit of the new Portsmouth Station of the Virginia Electric and Power Company at Gilmerton, Virginia, has recently been placed in service.

That's good news for that part of the country, for in addition to the normal load growth of such cities as Norfolk, Portsmouth, Suffolk, Newport News and others, there is a tremendous growth of both government and private projects which are creating large power demands on the system.

The Portsmouth Station, engineered and constructed by Stone & Webster Engineering Corporation, is ideally situated on a deep-water channel usually referred to as the South Branch of the Elizabeth River. Oil may be delivered directly to the plant by tanker. It is likewise immediately adjacent to the main line of a large railroad. This simplifies the matter of coal delivery while the rather large acreage occupied by the station provides adequately for both coal storage and ash disposal.

The first of the two turbine-generators, which comprise the initial section of the station, is now in service. Both are 100,000 kw preferred standard units and each is served by a C-E Steam Generating Unit of the type illustrated and briefly described on the opposite page. B-662

COMBUSTION ENGINEERING, Inc.

200 MADISON AVENUE, NEW YORK 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

Handclasp of a friend-in-need

There's confidence in the very "feel" of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers. The quick-acting "Squeez-Grip" fits your hand naturally like a handclasp ... hangs right ... carries right ... works right. You're in complete command of the situation instantly ... no fumbling ... no fatigue.

From the non-conducting, shatterproof discharge horn to the high strength, durably finished cylinder, you get top quality construction that results in a lifetime of satisfactory service. Because of the very few working parts and corrosion resistant materials throughout, the total cost to you over the years is less than other initially lower priced makes ... fire after fire, recharge after recharge, without trouble.

It's not hard to see, when you fully compare and try, why C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers are your best buy for killing flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. Sizes range all the way from 2½ to 100 pounds capacity ... all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus.

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting, inert gas ... smothers fire instantly, leaves no after fire mess ... harmless to equipment, materials and finishes ... even food is still perfectly edible.

Act now for complete free information on these first-rate, sure-acting fire extinguishers. Remember fire doesn't wait ... get the facts today!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

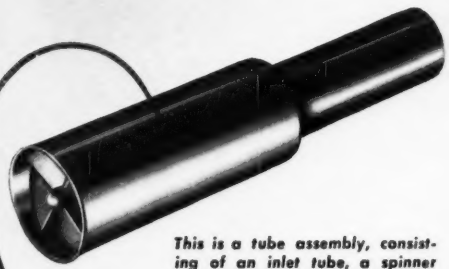
C-O-TWO FIRE EQUIPMENT OF CANADA, LTD. • TORONTO 8 • ONTARIO

Sales and Service in the Principal Cities of United States and Canada

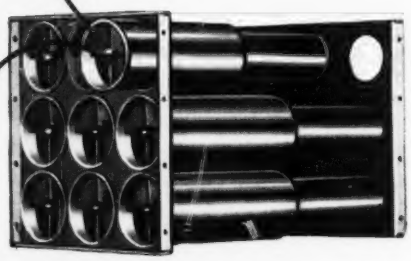
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

American Blower . . . a time-honored name in air handling

Beginning of the end of a fly ash problem

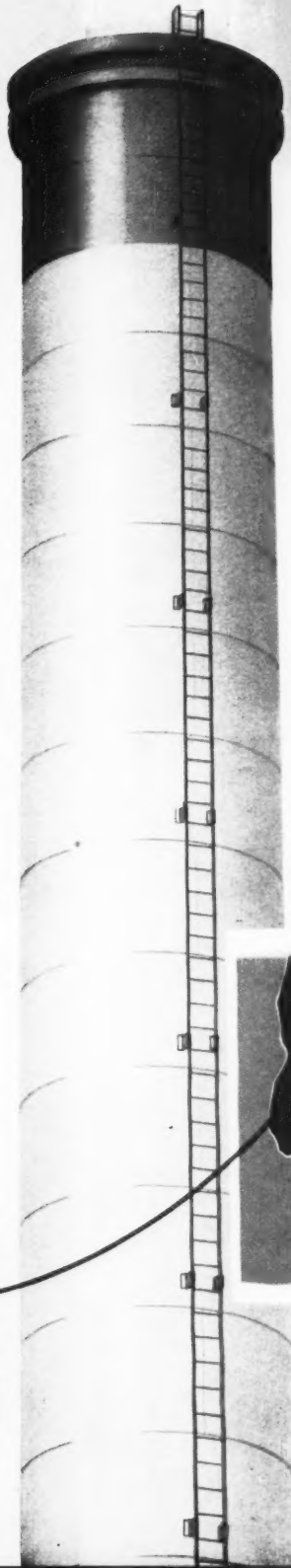


This is a tube assembly, consisting of an inlet tube, a spinner element and a smaller outlet tube.



Tube assemblies are grouped at the factory into convenient bundles, like the one above.

These bundles are assembled in banks to complete construction of the primary unit as your plant requirements dictate.



American Blower Type ST Precipitators are built up in banks, assembled at the factory, shipped in sections.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

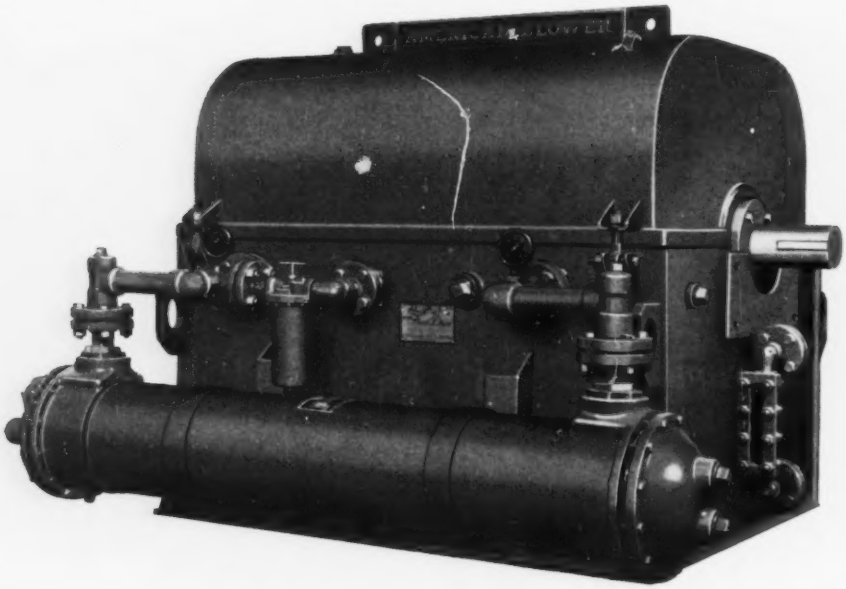
Fly ash ends here

SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR-TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER

American Blower . . . a time-honored name in power plant equipment



American Blower Class 4 Gyrol Fluid Drive

Memo to Power Plant Men —

You'll save power, eliminate starting shocks, get stable control over the entire range with American Blower Gyrol Fluid Drives on your forced and induced draft fans. It's the best means we know of to get stepless control from approximately 98% motor speed down to 20% with a simple constant speed driving motor.

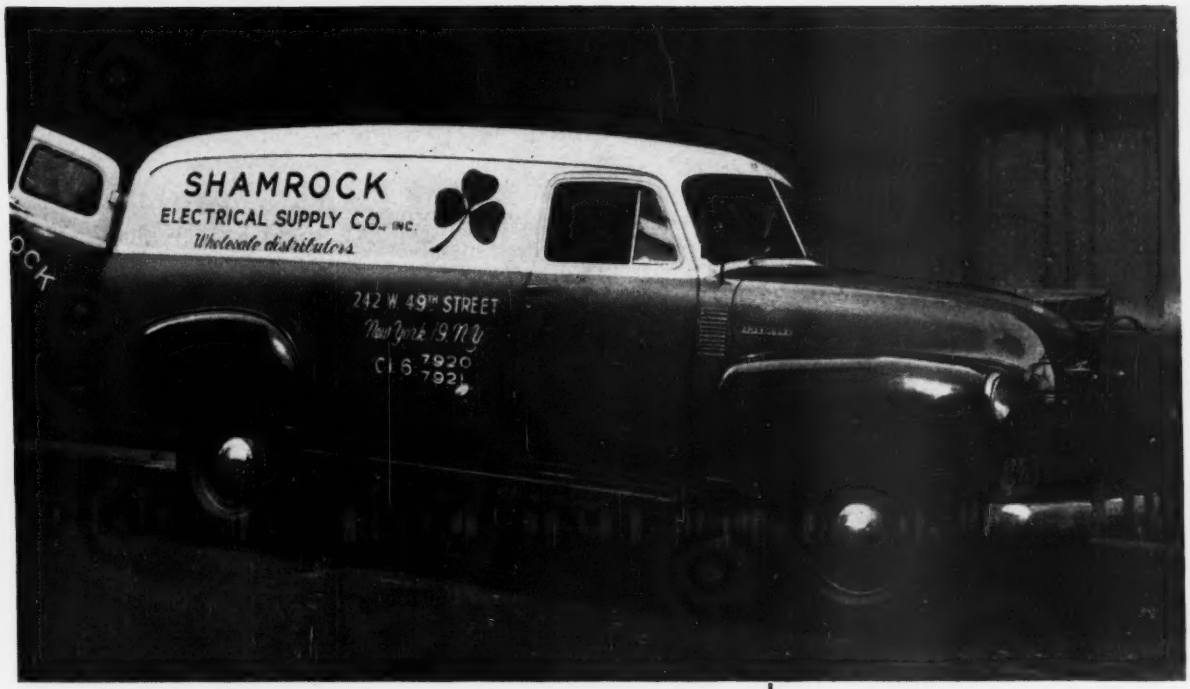
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER



CHEVROLET ADVANCE-DESIGN TRUCKS

More work per dollar ... and here are 4 powerful reasons why!

MORE POWER AT LOWER COST! Watch costs go down when you put the new heavy-duty power of Chevrolet's advanced Loadmaster engine to work! The new high-compression ratio of 7.1 to 1 in this great engine brings you more power and even greater economy than before. Chevrolet's Thriftmaster engine, too, in light- and medium-duty models offers exceptional economy of operation.

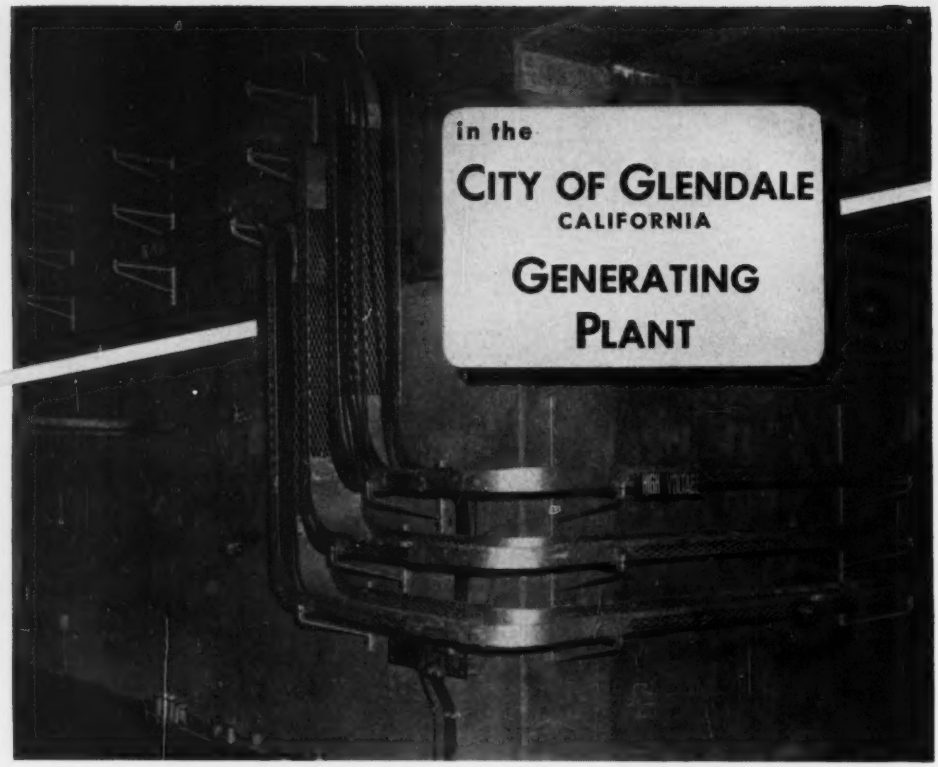
FACTORY-MATCHED TO THE JOB! Some jobs demand more power. Some demand stronger springs. But, *whatever* the requirements of your job, Chevrolet trucks are carefully *factory-matched* to the work to be done, with the *right* power—and the *right* units from tires to axle, springs to clutch—to handle that work at lowest cost.

MORE RUGGED THAN EVER! There is extra economy, too, in the exceptional stamina of Chevrolet trucks. You can expect new ruggedness and strength with heavier, more rigid frames and brawnier construction throughout. You can expect extra miles added to the life of your truck, plus a substantial reduction in the over-all cost of hauling.

LOWEST PRICED LINE! Chevrolet trucks are known for qualities and features matched by no other trucks. Yet, with all these advantages, the Chevrolet line lists for less than any other trucks of comparable size and specifications. See your Chevrolet dealer. Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the Loadmaster or the Thriftmaster—to give you greater power per gallon, lower cost per load. **POWER-JET CARBURETOR**—for smooth, quick acceleration response. **DIAPHRAGM SPRING CLUTCH**—for easy-action engagement. **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **HYPOID REAR AXLE**—for dependability and long life. **TORQUE-ACTION BRAKES**—on light-duty and medium-duty models and on front of heavy-duty models. **TWIN-ACTION REAR BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—for greater holding ability on heavy-duty models. **CAB SEAT**—with double deck springs for complete riding comfort. **VENTIPANES**—for improved cab ventilation. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—for easier handling. **UNIT-DESIGNED BODIES**—for greater load protection. **ADVANCE-DESIGN STYLING**—for increased comfort and modern appearance.



Cope CABLE TROUGH AGAIN PROVES ITS

... Simplicity of Installation
... All-around Economy
... Accessibility to Cable

The versatility and simplified design of the Cope system of Cable Trough and Fittings make it readily applicable to any layout. This is clearly seen in the above photograph showing part of a recent installation at the Glendale Generating Plant. Notice how the Cope Trough is supported by simple wall brackets. Observe, too, that both vertical and horizontal runs are made with standard trough and fittings — turns, branches and reductions.

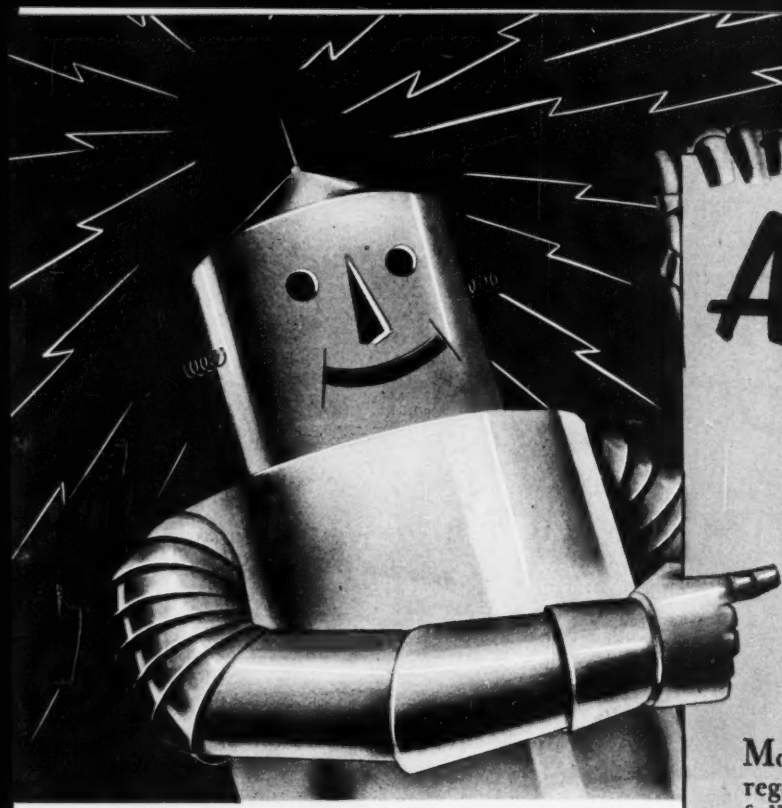
The High Voltage sign on the top tray emphasizes another Cope Trough feature. Here 480 volt Neoprene jacketed power cables are carried in the same tray with control cables. A barrier strip provides adequate separation while permitting easy access to the lines. The lower tray will carry 2400 volt Neoprene jacketed power cables and ultimately will be equipped with a solid Cope Trough cover. Future expanding needs will be met by adding a fourth tray above the other three.

Learn how you, too, can cut cable installation costs and labor . . . write for bulletin on Cope Cable Trough.

T. J. Cope INC.

You know Cope by these products

711 SOUTH 50th ST., PHILADELPHIA 43, PA.



AUTOMATIC

Demineralization and Silica Removal by Ion Exchange Resins

MOTOR and diaphragm-operated valves make regeneration of Permutit Demineralizers fully automatic. This gives more positive control . . . eliminates the possibilities of costly errors . . . saves valuable man-hours formerly spent in regeneration.

In a recent installation for a 1450 psi boiler, two compact Permutit units fill all make-up requirements, regardless of changes in turbine loads . . . deliver a continuous supply of demineralized, silica-free water. What better way to eliminate scale and silica deposits!

HIGHEST PURITY MAKE-UP

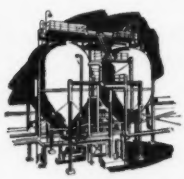
Effluents of Permutit Demineralizers have contained *total* electrolytes as low as 0.01 ppm and silica as low as 0.01 ppm! These values may be slightly higher under service conditions. In comparison, most distilled water contains 20 to 100 times more electrolytes . . . yet costs much more to produce.

INFORMATIVE NEW BULLETIN

You'll want this interesting book. Flow diagrams, illustrations and specifications explain key methods of demineralizing water and removing silica by ion exchange. Write for your copy, today!

THE PERMUTIT COMPANY, Dept. EW-7, 330 West 42nd Street, New York 36, N. Y., or the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal, P. Q.

OTHER BASIC WATER CONDITIONING PROCESSES



◀ Sludge Blanket Hot Lime Soda

Full utilization of Permutit sludge-blanket principle assures high efficiency. Reduces hardness to region of 20 ppm . . . silica to 2.0 ppm. Lowers alkalinity . . . removes wide variety of solids.

Hot Zeolite—Permutit Q ▶

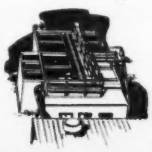
Permutit Q—a styrene base resin resistant to high temperatures and pH values—replaces second stage phosphate treatment in hot-process softener. Results—residual hardness is completely removed at great savings in phosphate costs.

◀ Deaerating Heater

Removes objectionable oxygen and CO_2 to prevent corrosion and pitting of feed lines, stage heaters, economizers, and boilers at high temperatures. Steam is used twice . . . deaerates water completely.

Precipitator ▶

Softens water on space and time-saving sludge-blanket principle. Simultaneously removes turbidity, color, fluorides, reduces silica and lowers alkalinity.

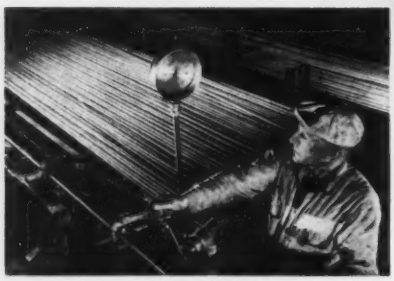


PERMUTIT

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

Chase Antimonial Admiralty

(a patented alloy)



Every Chase Antimonial Admiralty condenser tube is tested to withstand at least 1,000 pounds per square inch water pressure.

Meets every test for Condenser Tubes

Chase flattening test, index of Antimonial Admiralty tube's physical quality and ability to withstand bending or end flaring.

This Chase metallurgist is checking the size and uniformity of grain of Chase Antimonial Admiralty condenser tubes.

When you put Chase Antimonial Admiralty* tubes into a condenser you *know* they'll stand up for years. It isn't only that we make certain there's enough antimony to resist dezincification. Chase condenser tubes are carefully tested and retested for *every* physical and chemical property required to meet actual field conditions. It pays to insist on Chase Antimonial Admiralty.

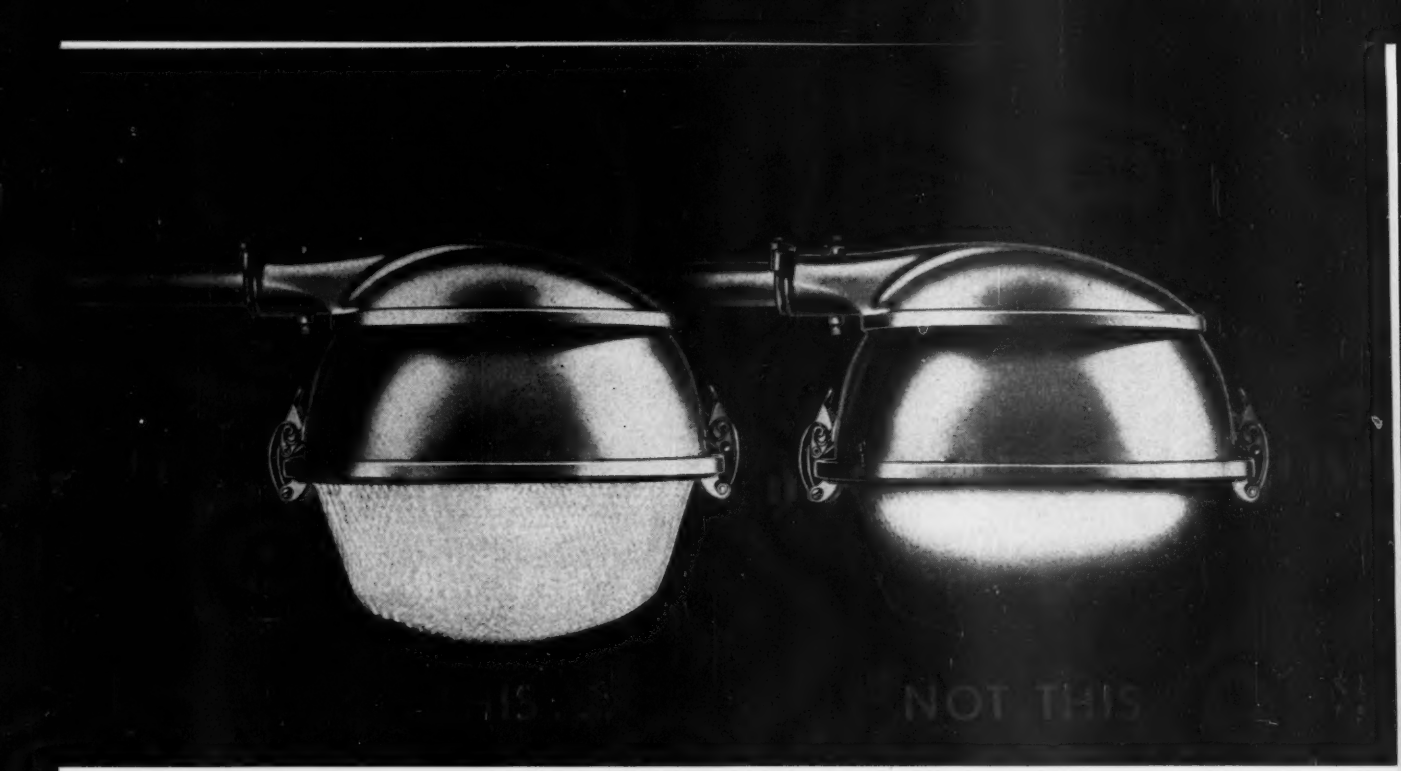
*U. S. Pat. No. 2,061,921

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester†	(† sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	



L-M "Ovalite" Design Cuts Glare, Provides Uniform Light Distribution On The Street

The two major requirements for good high-intensity lighting in business and traffic areas are:

1. minimum glare from the light source;
2. uniform lighting on the street surface.

Seen against a dark background, every lighting unit has some glare. The problem is to reduce the glare to a minimum. Glare obscures the roadway and makes it difficult to see pedestrians or unlighted objects in the street.

The L-M Ovalite is so designed that glare is reduced, while at the same time light is distributed more evenly on the street surface. Here's how we do it:

The mercury vapor lamp is placed so that the light center is about 2½ inches above the bottom edge of the reflector. Thus, when you are driving down the street, you don't look directly at the lamp.

The reflector is so designed that it distributes the light evenly on the glassware, so that no one area receives a majority of the light.

Vertical prisms on the inside of the glass refractor raise the angle of the light emitted from the refractor, directing it to give uniform surface brightness on the glassware, and at the same time distributing it evenly over the street area.

The result, so far as glare is concerned, is seen by comparison of the two photographs at the top of the page. In the left-hand unit, the Ovalite, light is distributed evenly from all parts of the glassware. The right-hand unit, which does not have the same efficient optical system, has a hot spot along the top edge of the glassware, which causes glare and uneven light distribution.

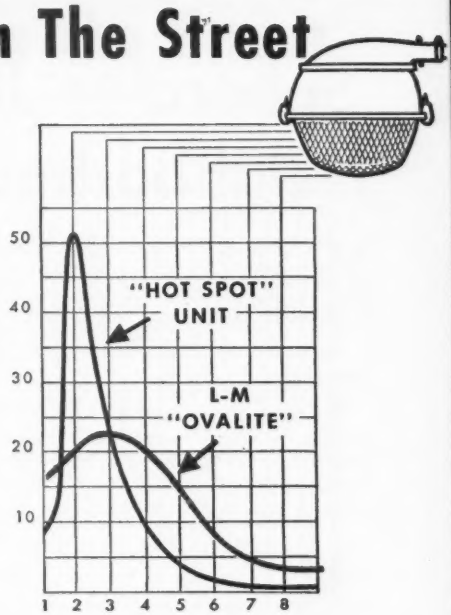
With its freedom from glare and its uniform distribution, the Ovalite gives greater safety and more efficient use of the light. Its optical system provides the wide distribution needed for business streets, shopping areas, and boulevards.

The Ovalite has many other good features—asbestos-covered internal wiring, strong construction, a double-hinge latch so you can swing the glassware down from either side. That makes servicing quick, easy, and safer.

Get The Whole Story

Ask the L-M Field Engineer for the "Ovalite" Bulletin—or write Line Material Co., Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

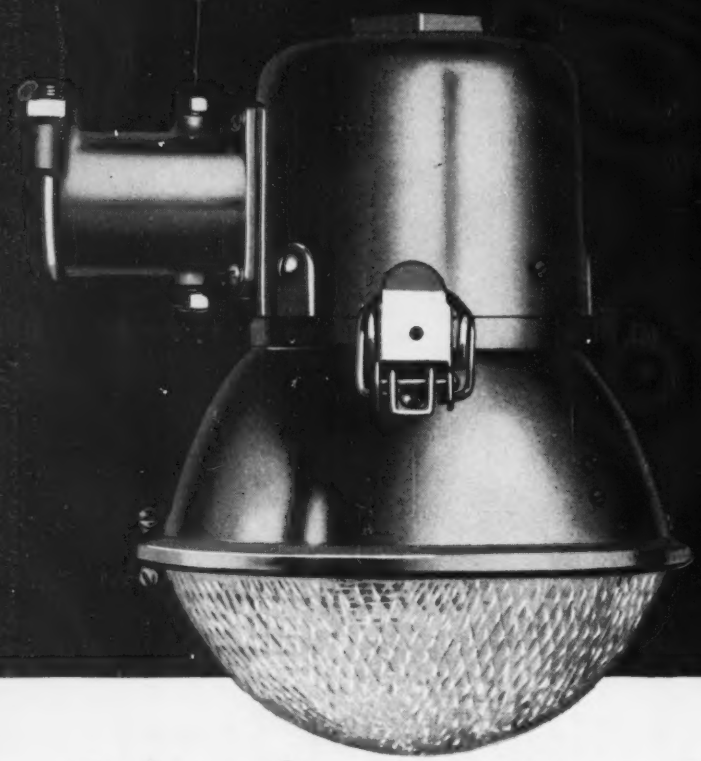
LINE MATERIAL
Street Lighting



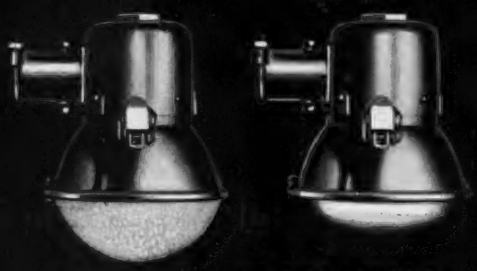
Tests Demonstrate Ovalite's* Uniform Brightness Distribution

To determine the relative brightness distribution of the "Ovalite" and a "hot spot" luminaire, measurements were made of the brightness of successive strips of the surface of each luminaire. Readings were taken in the main beam of both luminaires. The chart above shows that the brightness of the "Ovalite" is much more even, while the other luminaire peaks up, especially near the top of the glassware, which accounts for the hot spot seen in the right-hand picture at the top of the page. 121

*"*Ovalite*" *is a Line Material Company trademark.*



EVEN BRIGHTNESS DISTRIBUTION



THIS . . . *NOT THIS*

Spherolite Jr. Gives Good Lighting For Neighborhoods, Plus Interchangeability

L-M's Spherolite Jr. is a small, efficient luminaire for residential neighborhoods where narrow streets and wide light spacings prevail. It puts a high concentration of light in the main beam on the street, while shielding residential property.

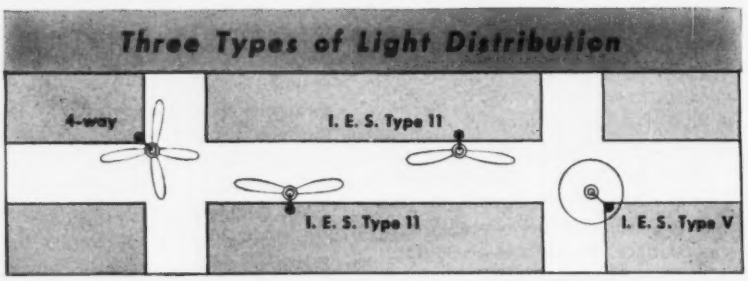
The unit is well designed and constructed to keep out dirt and moisture. Servicing is simple. Glassware may be removed by loosening the stainless steel V-Band holder, or reflector may be unlatched from the hood.

Complete Interchangeability

Spherolite Jr. fits both the 5000 volt Type A metal head and the wet process porcelain head. As traffic increases or the neighborhoods grows, the luminaire can be replaced with the larger standard Spherolite on the same heads. If you now have 600 volt multiple heads with radial bowls or open reflectors, you can replace these with the Spherolite Jr. without changing the heads.

Get Complete Information

Ask the L-M Field Engineer for details, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division). 125



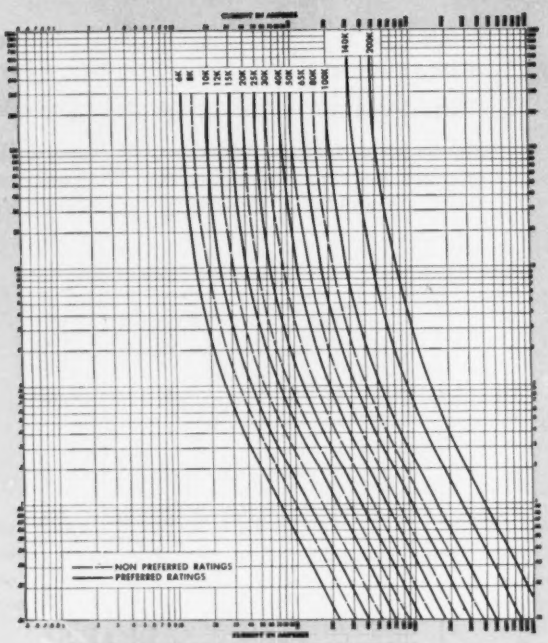
One reflector provides these three types of distribution, with three types of glassware. To change patterns you just loosen one screw in the V-Band holder and replace the glassware. It's quick and easy. No extra reflectors to stock.

Spherolite is a registered L-M trademark.

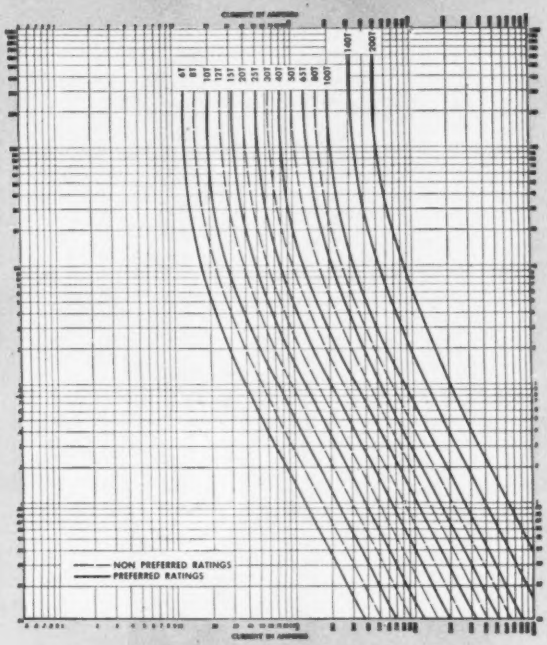
Spherolite Jr. with asymmetric patterns provides maximum beam at high vertical angles to compensate for wide spacings. The symmetric Type V is designed with lower beam angles for intersection or center parkway lighting. Details are given in Bulletin SL-2. Ask the L-M Field Engineer or write us for a copy.

LINE MATERIAL

LM® *Street Lighting*



"K" (fast) Links—minimum melting curves. Speed ratios vary from 6 to 8.1.



"T" (slow) Links—minimum melting curves. Speed ratios vary from 10 to 13.

Large size copies of these curves available from L-M on request

L-M Makes Available Complete Line Of New EEI-NEMA–Standard Fuse Links

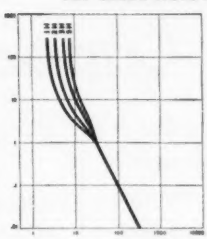
By R. D. Cleaves
Manager
Protective and Switching Equipment Sales
Line Material Company

A joint project between users, represented by EEI, and manufacturers, represented by NEMA, has recently resulted in the establishment of definite time-current characteristics for fuse links. These have now been adopted as standard by the industry, in sizes covering all major operating requirements.

As a major fuse link manufacturer, Line Material Company has now made available a complete line of links meeting the new standards. L-M's new EEI-NEMA Fuse Links offer you these benefits:

1. **Industry-standard mechanical and electrical interchangeability, with assurance of uniform degrees of coordination between adjacent link sizes.**
2. **Two speeds—"K", fast, and "T", slow —with time-current characteristics to meet all major operating requirements.**
3. **Better coordination with reclosers covering a wider range of fault currents.**
4. **Simplified purchasing, stocking, and application.**
5. **Positive performance, precise electrical characteristics, and guaranteed quality.**

New L-M High Surge Links for sizes below 6 amperes



L-M High Surge Links —minimum melting curves

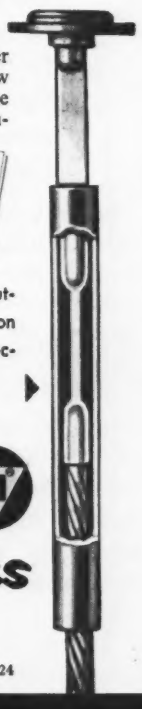
Today transformers are frequently worked up to their maximum thermal capacity. In protecting from overload, the protecting fuse link should remove the transformer from service whenever this capacity is exceeded. But it is important that the fuse link does not blow from surges and momentary overloads, causing needless outages and service trips.

Links large enough to stand these surges will not give adequate overload protection. Therefore L-M has provided a line of High Surge Links in 1, 2, 3, and 5 ampere sizes, which will stand the momentary inrush currents, and yet provide adequate protection.

These links have characteristics similar to 1, 2, 3, and 5 ampere N-rated links on the low current end, and 10 ampere N links on the high current end. These L-M High Surge Links allow good coordination with either the 10-"K" or 8-"T" EEI-NEMA links; and they supplement the EEI-NEMA-standard line.

Get Full Information

Ask the L-M Field Engineer for details and copy of new Bulletin FC5A. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

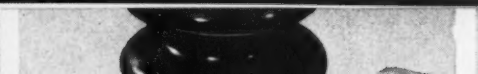


Rating clearly marked on button. One-piece forged button and shank. Horn fibre protective tube. Die-cast tin fusible section.

LINE MATERIAL

fuse cutouts and fuse links

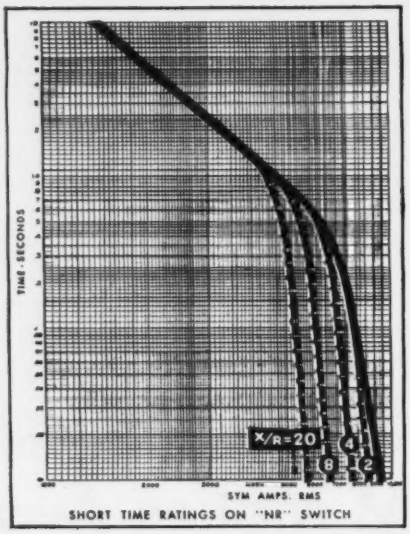
It's Time to Roll Up Your Sleeve—Give Blood Now



L-M's Kyle Type "NR" remote control oil switch—the same switch used in L-M's switched capacitor racks.

"Field-Designed"—with the features users asked for.

200-amperes nominal load rating at 14.4 kv, 150 amperes for capacitor switching. 9000 amperes RMS asymmetrical momentary current rating.



SHORT TIME RATINGS ON "NR" SWITCH

Data 235A

L-M's "NR" Remote Control Oil Switch Provides Low Cost Capacitor Switching

Here is L-M's new motor-operated 200-ampere remote control oil switch. It is specially designed for low-cost capacitor switching up to 3500 kvar 3-phase, but is equally suitable for street lighting, flood and airport lighting, protective lighting, sectionalizing, and other remote control switching applications. Ratings meet users' needs and requirements for capacitor switching and many other applications.

The contact structure is so designed that heavy currents increase contact pressure and give the switch high momentary and short-time current ratings. Spring-loaded contacts give very fast "make" and "break"—which eliminates restrikes and minimizes contact erosion when closing in on large capacitor banks.

The switch can be bolted directly to the pole, or crossarm with a thru-bolt or crossarm-mounted with a clamp-around hanger. Clips also available for mounting on substation steel structure.

Control motor requires less than one ampere at 120 volts, which permits the lightest wiring, simpler control circuit, and gives longer life for limit switches and relays.

Get Full Information

Ask the L-M Field Engineer for details on this new Type NR Switch—or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

Type "NR" Switch Ratings

SINGLE PHASE

VOLTAGE

Nominal	RMS 14.4 kv
Maximum design	RMS 15.0 kv
60 cycle, one minute withstand, dry	RMS 35.0 kv
60 cycle, ten-second withstand, wet	RMS 30.0 kv
1½ x 40 Ms impulse withstand, crest, BIL	95.0 kv

CURRENT

Thermal	200 amperes
Capacitor switching, nominal	150 amperes
Inductive load switching,	
75 to 100% PF	200 amperes
50 to 75% PF	100 amperes
Less than 50% PF	50 amperes
Momentary, RMS Asymmetrical	9000 amperes
Short-time, RMS Symmetrical	
10 seconds	1400 amperes
1 second	4500 amperes

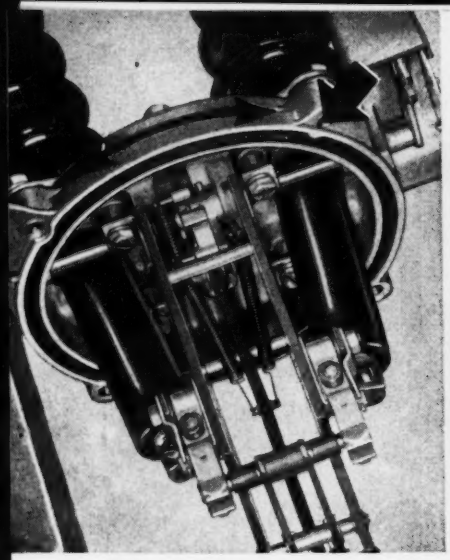
For larger ratings at shorter time intervals see curve, Data 235-A above.

CONTROL

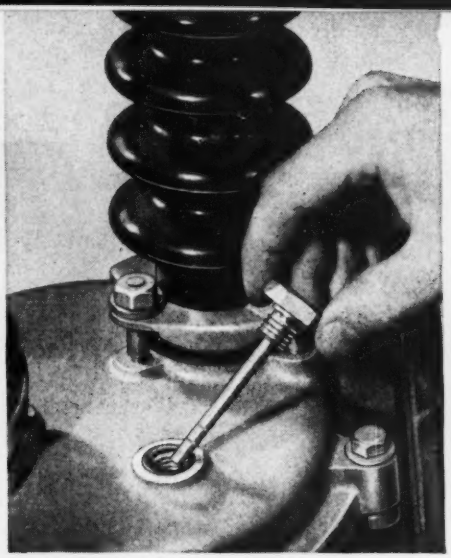
Motor-operated actuator requires less than one ampere at 120 volts. Permits simplest control circuit and gives long life of limit switches and control relays.

characteristics, and guaranteed quality.

It's Time to Roll Up Your Sleeve—Give Blood Now

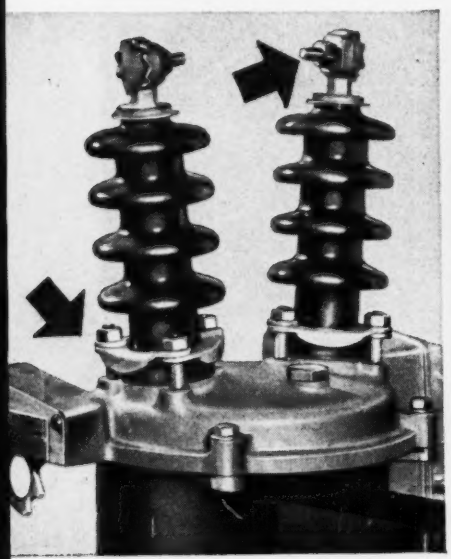


Head may be rotated and set at desired position. Lips in the groove on the underside of head hold the gasket so that it doesn't fall out when the cover is lifted.

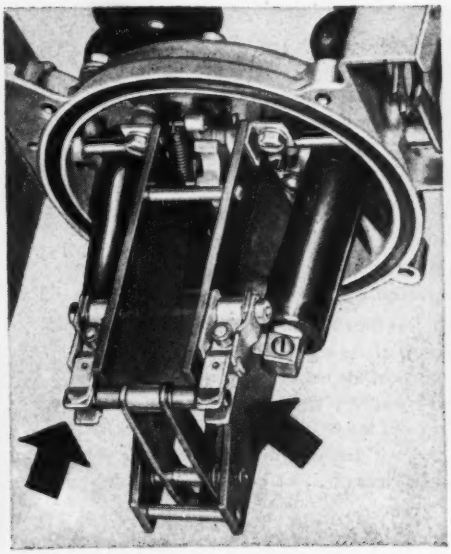


Oil dip stick on the head for checking the oil level. The tank holds 1½ gallons of oil. The inner mechanism is insulated from the tank by the oil and by a tank liner.

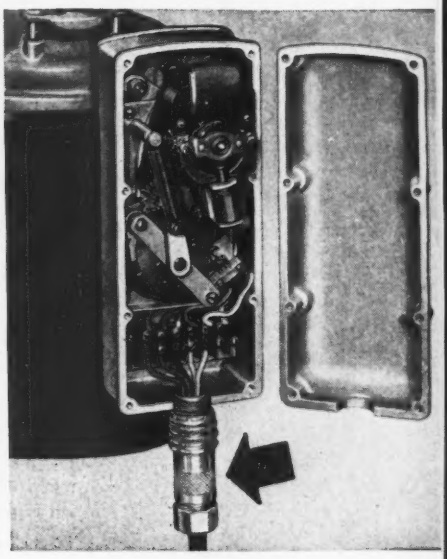
Heavy bracket for direct mounting to pole or crossarm with or without a hanger. Heavy tank, with inserted concave bottom, so that only the rim takes abrasion.



The bushings are the clamp-on type which make replacement easy. Bushings are oil-filled for lowest radio noise level. Plated Universal terminals for aluminum or copper conductor, No. 8 to 2/0.



Contacts arranged so heavy currents increase contact pressure, giving high momentary and short time current ratings. Spring-loaded contacts give quick make and break to prevent restrikes and minimize erosion.



Motor-operated actuator requires less than one ampere at 120 volts, permitting lighter wiring and simplest control circuit, and assuring long life for limit switches and relays. Weatherproof plug-in connection at bottom of box and weatherproof plug available.

CAPACITOR SWITCHING RATING

Voltage	Based on 25 KVAR Units				Based on 15 KVAR Units			
	Three-Phase		Single-Phase		Three-Phase		Single-Phase	
	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units
2400	600	24	350	14	585	39	360	24
4160	1050	42	625	25	1080	72	615	41
4800	1200	48	725	29	1215	81	720	48
7200	1800	72	1075	43	1845	123	1080	72
12470	3225	129	1850	74	3240	216	1860	124
13200	3375	135	1975	79	3420	228	1980	132
13800	3525	141	2050	82	3555	237	2070	138

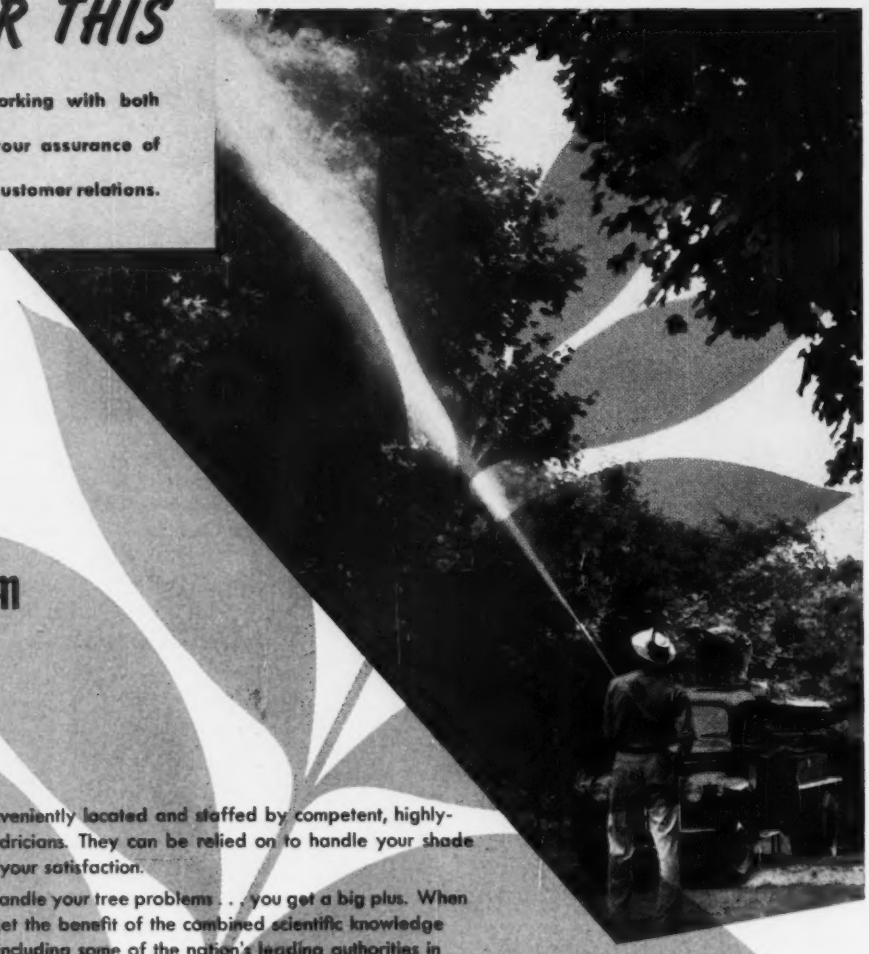
LINE MATERIAL

Kyle® Oil Switches

Like all Kyle reclosers, the Type NR switch is filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

REMEMBER THIS

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.



Bartlett branches stem from research

Bartlett branch offices are conveniently located and staffed by competent, highly-skilled diagnosticians and dendricians. They can be relied on to handle your shade tree problems skillfully and to your satisfaction.

But in employing Bartlett to handle your tree problems . . . you get a big plus. When you consult with Bartlett, you get the benefit of the combined scientific knowledge and long practice of a group including some of the nation's leading authorities in tree health and protection. Scientists are continually searching for new and better ways to protect the shade trees of America at the Bartlett Tree Research Laboratories in Stamford, Connecticut. So, any decision your Bartlett Representative makes is not based on his own individual judgment . . . it's based on years of experience of the whole Bartlett organization.

That's why a great many Bartlett clients engage Bartlett services on a yearly basis to care for their trees and guard them against insects and disease. They appreciate the continual improvements and advancements the Bartlett Way provides.

No wonder those who are critical of results are turning more and more to the Bartlett Way. You, too, can benefit by Bartlett services. Call the nearest Bartlett office for a study of your tree condition.

The Bartlett Way

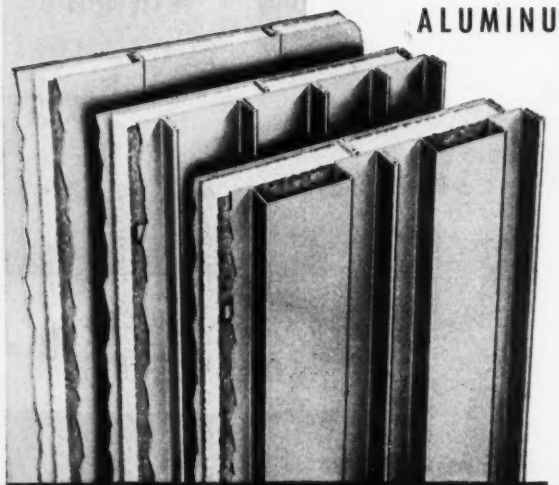
BARTLETT TREE EXPERTS, *Stamford, Conn.*

Branch Offices: Rutland, Windsor, Vt.; Concord, Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Osterville, Pittsfield, Prides Crossing, Mass ; East Providence, R. I.; Danbury, Hartford, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Southampton, Syracuse, Westbury, White Plains, Yorktown Heights, N. Y.; Bernardsville, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Zanesville, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Charleston, Huntington, W. Va.; Kingsport, Tenn.

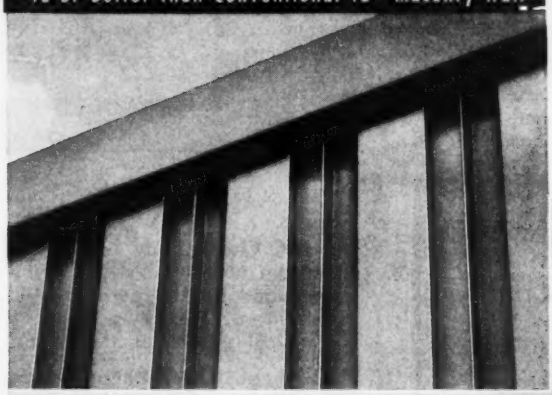
INSULATED METAL WALLS

for INDUSTRIAL and COMMERCIAL BUILDINGS

ALUMINUM, STAINLESS or GALVANIZED STEEL



FLUSH, RIBBED, or FLUTED
Over-all "U" Factor of Various Types is Equivalent to or Better than Conventional 16" Masonry Wall

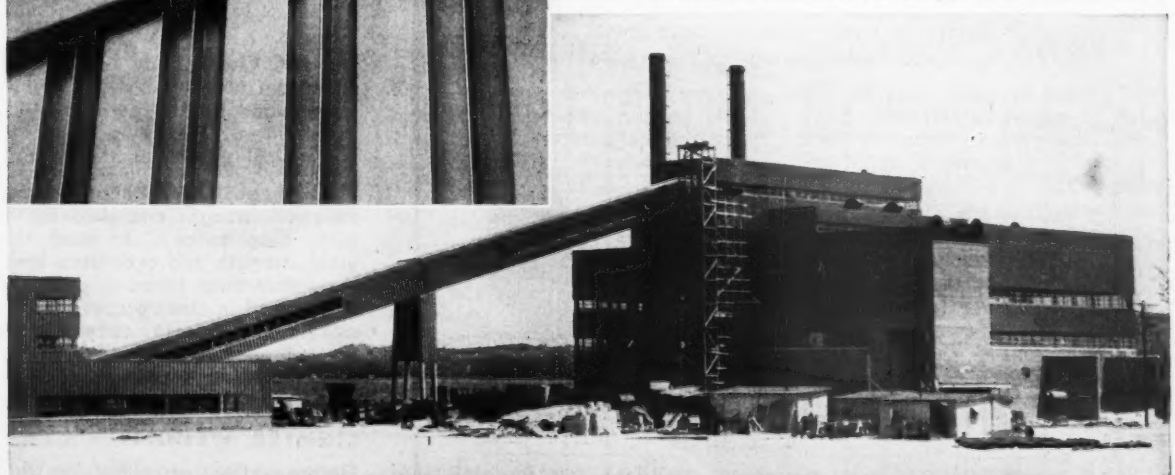


Today, Insulated Metal Walls are saving construction dollars in both material and labor costs . . . they are reducing construction time through rapid erection—even in periods of extremely low temperature. This amazingly light weight construction, with an over-all "U" Factor superior to a conventional masonry wall, permits further economies in the building frame or supporting structure. Architects, as well as owners and management groups throughout the country are revising their concept of permanent exterior wall construction. In the powerhouse illustrated below, Mahon Fluted Type, Field Constructed Insulated Metal Walls with galvanized steel exterior plates were employed to good advantage for virtually all exterior walls. Mahon Insulated Metal Walls are available in the three exterior patterns shown at left . . . each lends itself to individual architectural expression in building design. The Mahon "Field Constructed" Fluted or Ribbed Wall can be erected up to sixty feet in height without horizontal joints—a feature of Mahon Walls which is particularly desirable in powerhouses, steam plants, warehouses, auditoriums, or other buildings where high expanses of unbroken wall surface are common. See Sweet's Files for complete information including Specifications, or write for Catalog No. B-53-B.

THE R. C. MAHON COMPANY

Detroit 34, Mich. • Chicago 4, Ill. • Representatives in all Principal Cities

Manufacturers of Insulated Metal Walls; Steel Deck for Roofs, Partitions, and Permanent Concrete Floor Forms; Rolling Steel Doors, Grilles and Underwriters' Labeled Rolling Steel Doors and Fire Shutters.



MAHON

DROP-FORGED for GREATER STRENGTH

BTC

M.P.L. Aluminum

SUSPENSION CLAMP

for A.C.S.R.

and All-Aluminum Conductors

MINIMUM POWER LOSS

INCREASED CONDUCTOR LIFE

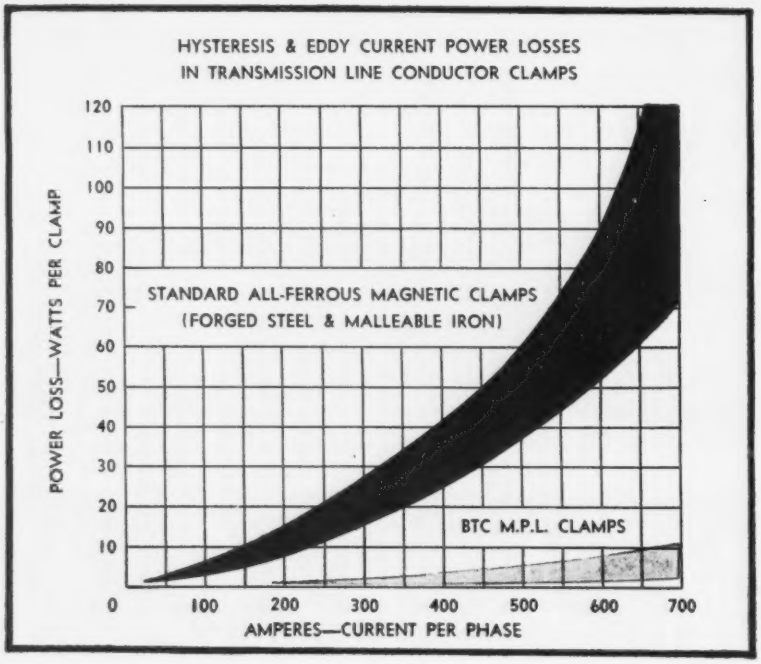
STRONGER

MPL **MINIMUM POWER LOSS**

The use of non-magnetic Aluminum Alloy Clamp Body reduces eddy current and hysteresis losses to a minimum . . . prevents temperature rise in the clamped section of the conductor, which will operate at lower temperature than in the span.

CONSIDERABLY STRONGER

Forgings, in any metal, are employed where better strength, soundness and finish are required than can be obtained by other processes. Forging produces a fine, close-grained structure, with the grain flow following the contour of the part and with optimum mechanical properties and ability to withstand severe loading, sudden shock and frequent reversal of stress.

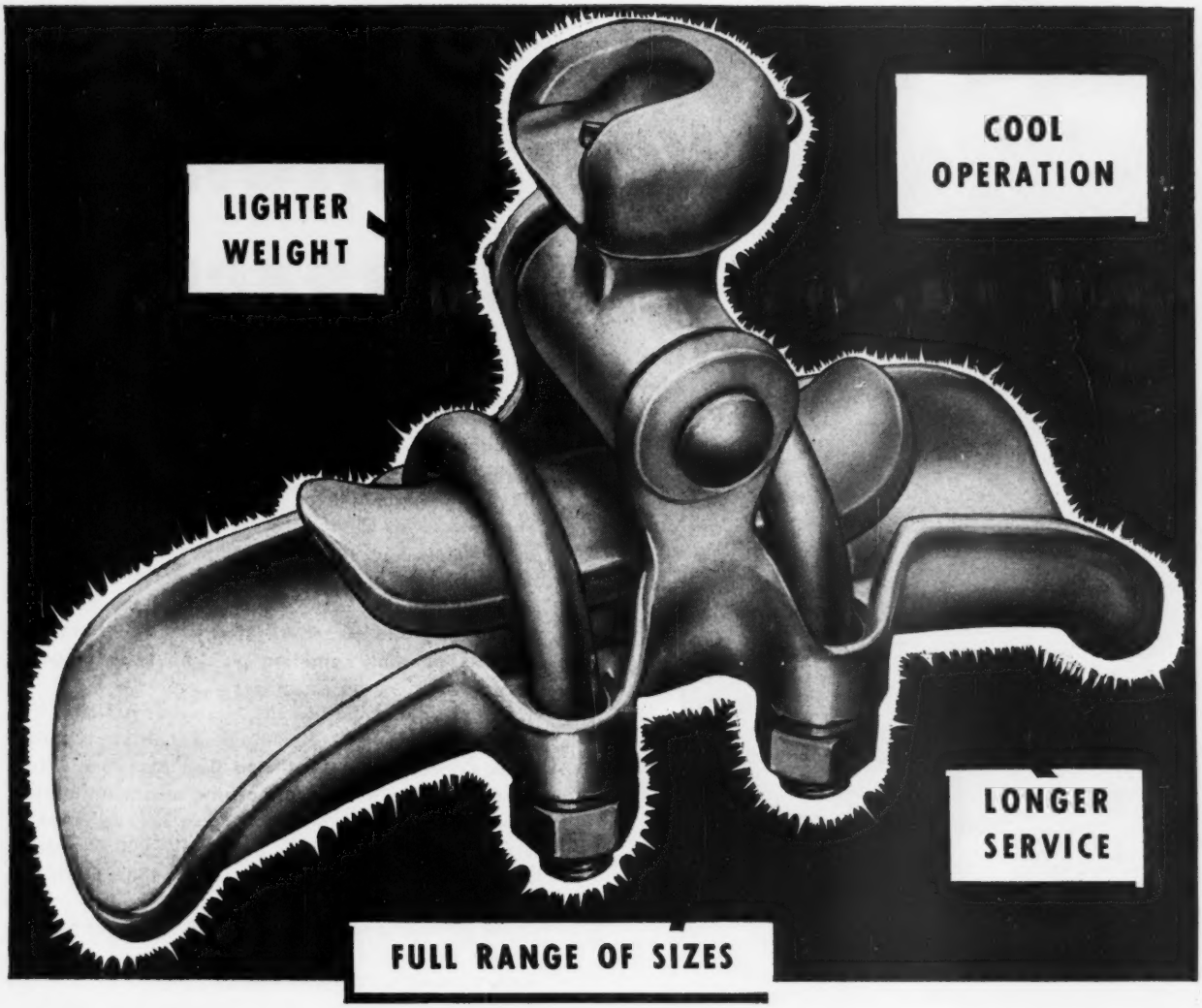


The BTC Clamp Body is FORGED Aluminum alloy, the strongest recommended for the purpose, fully heat-treated to develop maximum mechanical properties.

In the heat-treated condition, the ultimate strength and hardness is more than twice . . . and the yield strength and endurance limit more than three times . . . that of alloys used in other processes. The more-than-adequate catalouged strength ratings of BTC Clamps are conservative and are exceeded in actual tests.

LIGHTER WEIGHT

Heavy sections or reinforcing ribs, necessary in other materials to develop desired strength and prevent collapse or breakage of the clamp under clamping U-Bolt pressure, are not required in forged clamps. Undesirable weight is eliminated without sacrifice of strength.



INCREASED CONDUCTOR LIFE

The light weight and generous longitudinal radius of the conductor seat minimize the effects of conductor vibration. The conductor is not bent over a small radius at any point.

Clamping pressure is greatest at the center, gradually decreasing toward each upswept end of the keeper. Clamp and Keeper ends are liberally bell mouthed and beaded to prevent conductor damage and formation of corona.

The conductor is fully supported in the clamp body. There are no open pockets at U-Bolt holes to allow distortion of the conductor under clamping pressure.

LONGER SERVICE

The superior strength insures against failure under severe loading. The greater hardness prevents excessive wear at points in contact with the supporting pin.

The close-grained, non-porous structure of the forged clamp body effectively prevents the destructive internal seepage of corrosive elements, a cause of failure in some transmission line fittings produced by other processes.

FULL RANGE OF SIZES

BTC offers a choice of exactly the right clamp for each size of A.C. S.R. or all-aluminum conductor. The close dimensional fidelity of the die-forged and die-formed parts makes unnecessary any bore size allowance for manufacturing variations in the clamps.

Specify BTC MPL Aluminum Suspension Clamps from your insulator manufacturer. They are an important part of BTC's complete line of forged transmission line hardware.

Sold Through Your Insulator Manufacturer Only

Drop Forged **BTC** *Hi-Line Hardware*

The BREWER-TITCHENER Corporation

Cortland • New York

30 years unfailing and NO TRACE of

TIME-TESTED . . . PERFORMANCE-PROVED

Through 30 years of uninterrupted service, this multi-gap resistance type arrester has protected the lines of a large Southern power company. "Service-engineered" by ESM Co. for long-life dependability, its porcelain housing was ventilated.

Examination of the unretouched photos of the gap assembly show that ventilation kept the interior always dry and clean. All electrodes were still in perfect operating condition . . . no trace of gap corrosion.

For 17 years the same time-tested advantages of gap ventilation have eliminated all moisture trouble from Crystal Valve Ventilated Gap Arresters. Free access of air in and out of housing means no moisture can accumulate to corrode gap electrodes, cause arrester failure. Result: A practically 100% record of perfect protection on thousands of installations all over the world.

For positive protection on every line, get the time-tested performance-proved reliability of Crystal Valve Ventilated Gap Arresters.

Write today for illustrated folder with full details.

After 30 years, all electrodes are still smooth, clean and uncorroded by moisture.

Secret of 30 years' dependability lies in gap ventilation through this opening in lower cap. Same principle assures reliability of today's Crystal Valve Ventilated Gap Arrester.

protection...

GAP CORROSION!

CRYSTAL VALVE

Ventilated Gap

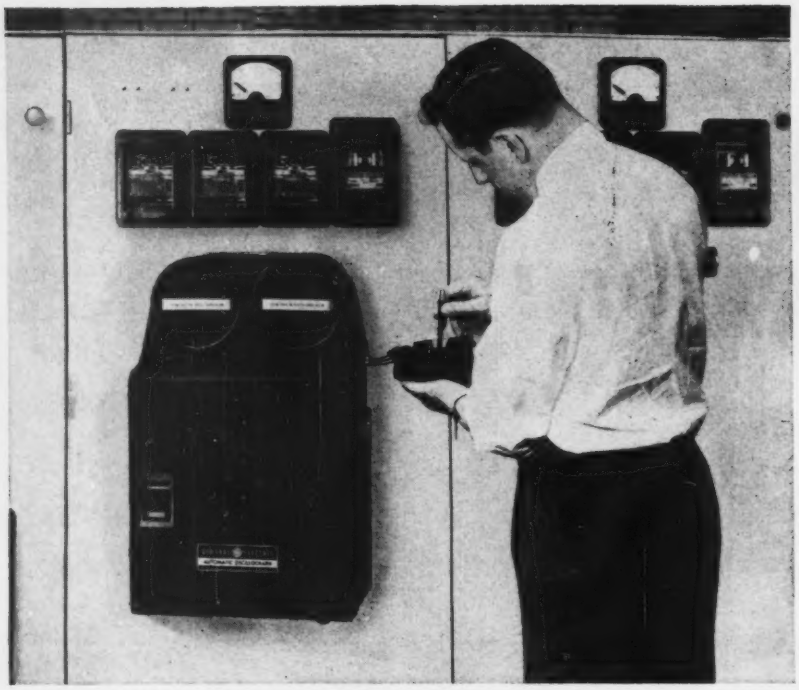
LIGHTNING ARRESTER

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PA.

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

ULTRA-SPEED GAP FOR FASTEST PROTECTION
VENT OPENINGS ELIMINATE CORROSION DUE TO MOISTURE
CRYSTALLITE GIVES MULTI-PATH DISTRIBUTION OF SURGE
ESM
Service Engineered by ELECTRIC SERVICE



NEW TIME RECORDER OF PM-13 NEEDS ONLY PERIODIC ADJUSTMENT (SHOWN ABOVE)

GENERAL ELECTRIC ANNOUNCES . . .

New Automatic Oscillograph

General Electric's new PM-13 oscillograph is designed to automatically record power-system transient disturbances. Equipped with seven fluid-damped galvanometers, the instrument simultaneously records seven electrical wave forms that have been pre-selected by the system engineer.

In power-company generating and switching stations, the new PM-13 may be used to measure and record such quantities as residual current, phase current, phase/ground potentials, phase phase potentials, and Kw or Kva. Information provided by the oscillograph enables the system engineer to analyze the performance of circuit breakers, relays, or systems; and to locate system faults.

NEW LIGHT SOURCE

A flooding-type light source illuminates all seven of the new instrument's galvanometers. Because no lenses, prisms, or aperatures are used, no time-consuming optical adjustments are necessary when replacing lamps.

IMPROVED TIME RECORDER

The new PM-13 oscillograph is equipped with an automatic time recorder which photographically records the time and date of operation on the face of the oscillogram. For station or company identification, a plate may be added to the time mechanism.

UNIT CONSTRUCTION

Constructed of simplified unit subassemblies, the front relay panel of the new G-E oscillograph is easier to inspect and maintain.

SIMPLIFIED PAPER HOLDERS

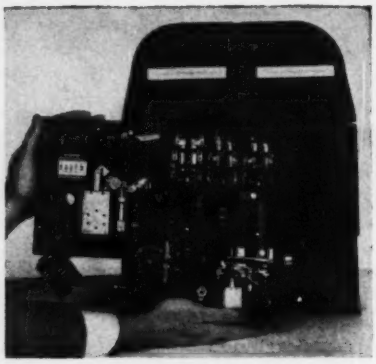
New, light-tight record paper holders mount easily on the top of the oscillograph. Holding up to 200 feet of record paper, the new holders make it possible to obtain as many as 100 oscillograms without adding paper.

FURTHER INFORMATION

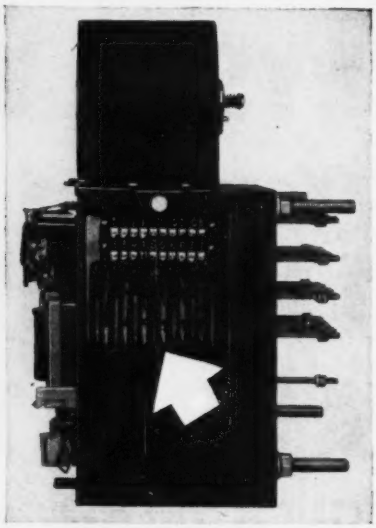
For further information, contact your local G-E Apparatus representative, or write for Bulletin GEC-396 to: Section 605-41, General Electric, Schenectady 5, N. Y.

You can put your confidence in—

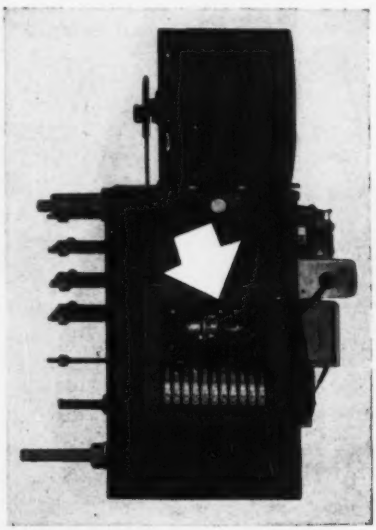
GENERAL ELECTRIC



UNIT SUB-ASSEMBLY CONSTRUCTION permits easy removal of the front panel for adjustment and repair.



SEVEN GALVANOMETERS (arrow) are easily accessible on right side of unit; provide for seven simultaneous records.



LIGHT SOURCE (arrow), left side of unit, is easy to replace; no time-consuming optical adjustments are required.

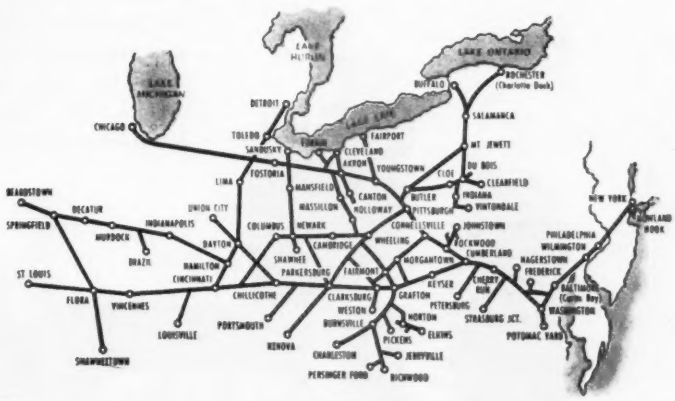
Whatever your fuel needs, we have a coal that is

Just the Ticket!

• In fact, you can write *your own* ticket—for the vast Bituminous fields served by the Baltimore & Ohio contain excellent coals *in wide variety*. For centuries to come, these coals will be available—a dependable source of low-cost heat and energy.

Modern mechanization at the mines assures low costs as well as uniform size and quality. The location of the fields—close to industry's front door—contributes to low transportation expense. Storage is economical because costly facilities are not required. And with the help of new combustion methods and equipment, Bituminous offers its users an increased burning potential.

ASK OUR MAN! He can give you worthwhile advice as to supply sources and burning methods for the particular coal you need. The efficiency, economy, and cleanliness of B&O Bituminous today will be a revelation!



LINKING 13 GREAT STATES WITH THE NATION

B&O

BALTIMORE & OHIO RAILROAD

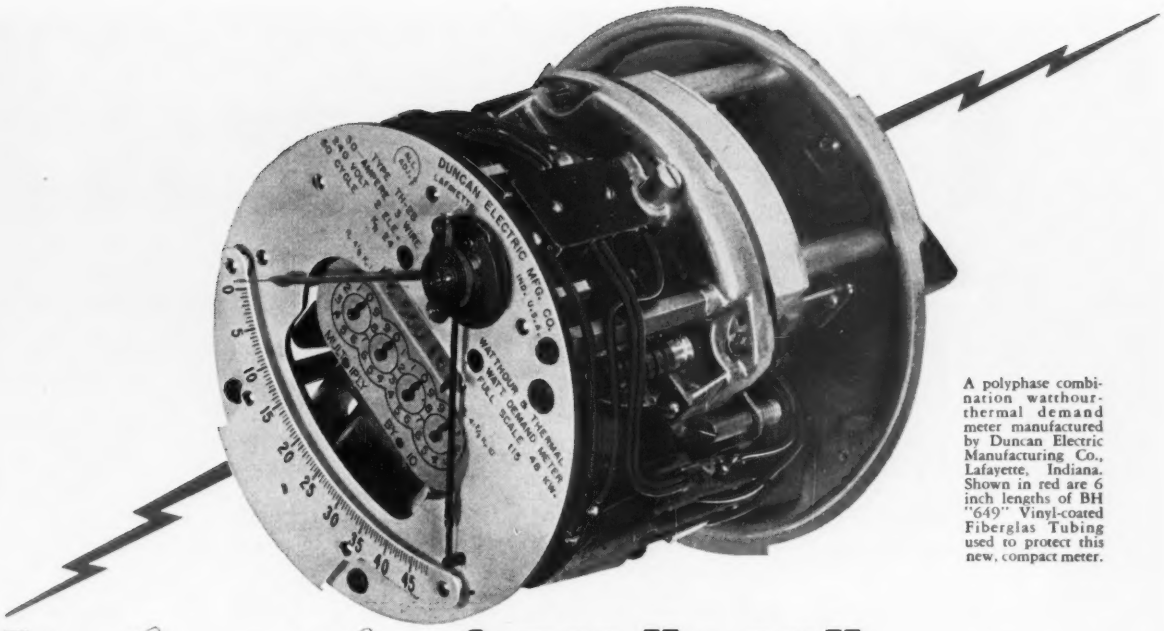
Constantly *doing things*—better!

IT'S TIME TO START COUNTING INCHES OF LEAKAGE DISTANCE ...AND EVALUATING ITS EFFECTIVENESS

Every urban area is a potential source of contamination. And the trend is rapidly toward the worse in this regard. Greatly increased numbers of automobiles are concentrated in city areas. Much increased industrial activity, particularly involving chemical processing, throws out more and more atmospheric contamination, most of which seems to deposit as conductive dirt on line and station insulators. Evidence is in the increasingly frequent reports of leakage current flashovers—and of the need for insulator change outs and frequent washing (which at 1953 labor rates is no small factor).

The simplest answer is to buy insulators on the basis of leakage distance—and we want you to know that Lapp Fog-Type insulators, in suspension units, Line Posts and Station Posts, offer more inches of leakage distance per dollar than any other type of insulator. But more important even than inches-of-leakage-distance is the *nature* of the leakage surface. Lapp Fog-Type design is based on the principle of *uniform* leakage surface, without narrow shielded hot-spots—and of a leakage surface exposed to natural wetting and the cleansing action of wind and rain.

From all standpoints—initial cost, maintenance, and security of service—there's wisdom in the specification of Lapp Fog-Type insulators for all line and substation duty in and around cities. Lapp Insulator Co., Inc., Le Roy, New York.



A polyphase combination watthour-thermal demand meter manufactured by Duncan Electric Manufacturing Co., Lafayette, Indiana. Shown in red are 6 inch lengths of BH "649" Vinyl-coated Fiberglas Tubing used to protect this new, compact meter.

1¢ *lengths* of BH "649"— safe — even when lightning strikes

Used by utility companies for metering customer's watt demand load and kilowatt-hour consumption, the new Duncan polyphase thermal demand meters, insulated with BH "649" Fiberglas Tubing, are the first to be built into a standard circular glass meter cover. Extremely compact, good insulation is an absolute necessity.

Here's what Duncan says — "We selected BH "649" after testing several types of insulating tubing. Our meters must stand up against lightning and other transient conditions on utility lines. BH "649" does — allows for a longer periodic maintenance schedule.

"Meter insulation must resist assembly soldering temperatures of 450°F. and not melt or char. It must resist ambient operating temperatures from —40°F. to 160°F. It must take a bend and maintain a level of 5,000 volts RMS. BH "649" has easily passed these tests. It helps us maintain our high standards and has materially reduced rejects."

Whatever your concern — excessive current — vibration — temperature extremes — flexibility — moisture, oil and fungus resistance — or what — let us help you. Send required voltages and temperatures encountered. We'll make recommendations and send you production testing samples from the big, trustworthy family of BH Tubings and Sleevings for electrical insulation.

Address Dept. W-7
Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH FIRST IN
use of Fiberglas
heat-treated Fiberglas
true high temperature flexibility
vinyl-coated Fiberglas
silicone rubber coating
colors in silicone rubber
true Class B (130°C.) protection

BH *Fiberglas** SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

General

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"More Power to You"

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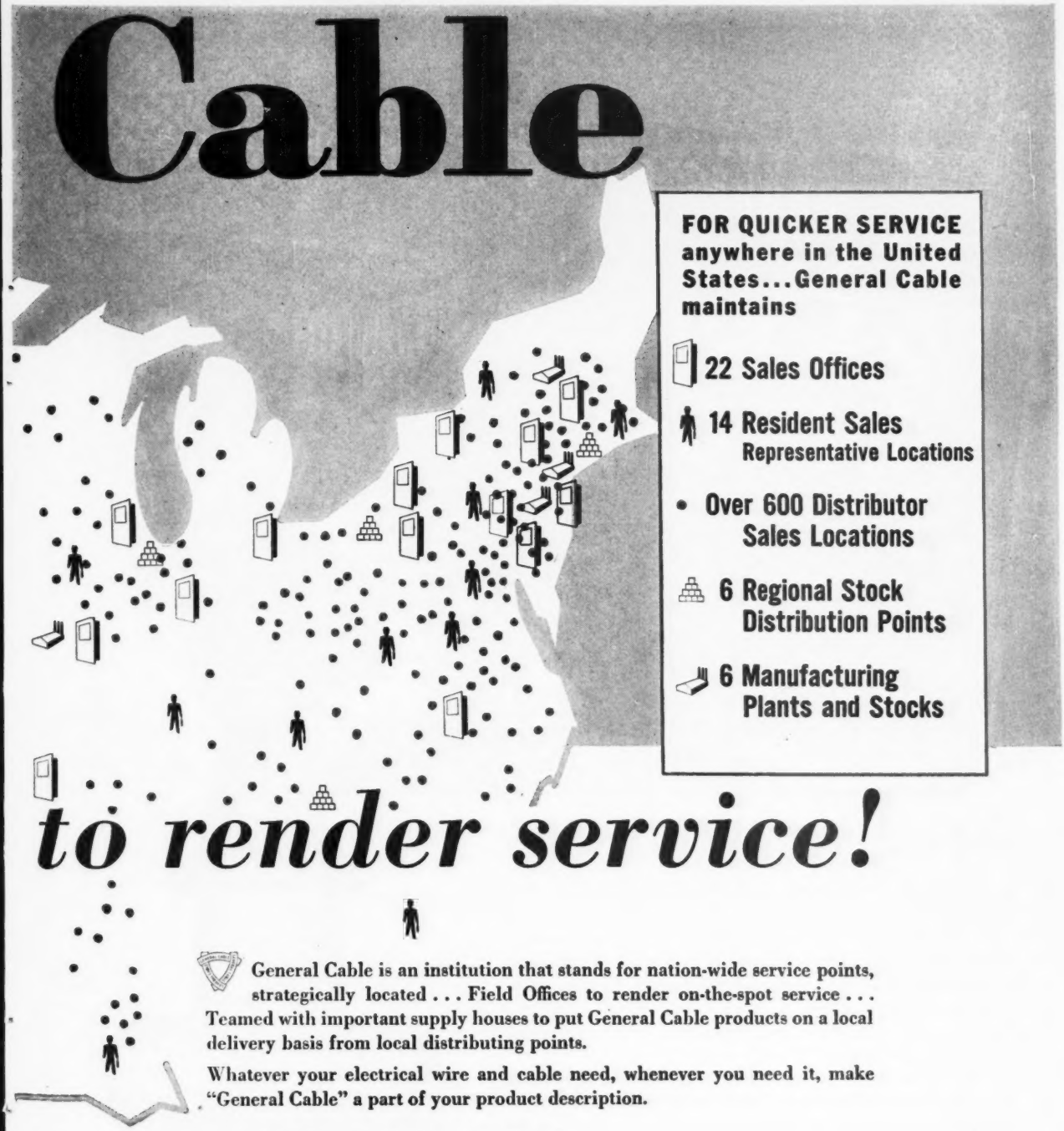
Cable



FOR QUICKER SERVICE anywhere in the United States...General Cable maintains

- 22 Sales Offices
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to render service!

General Cable is an institution that stands for nation-wide service points, strategically located . . . Field Offices to render on-the-spot service . . . Teamed with important supply houses to put General Cable products on a local delivery basis from local distributing points.

Whatever your electrical wire and cable need, whenever you need it, make "General Cable" a part of your product description.

One Source of Complete Supply
One Completeness of Service
One Standard of Quality

GENERAL CABLE
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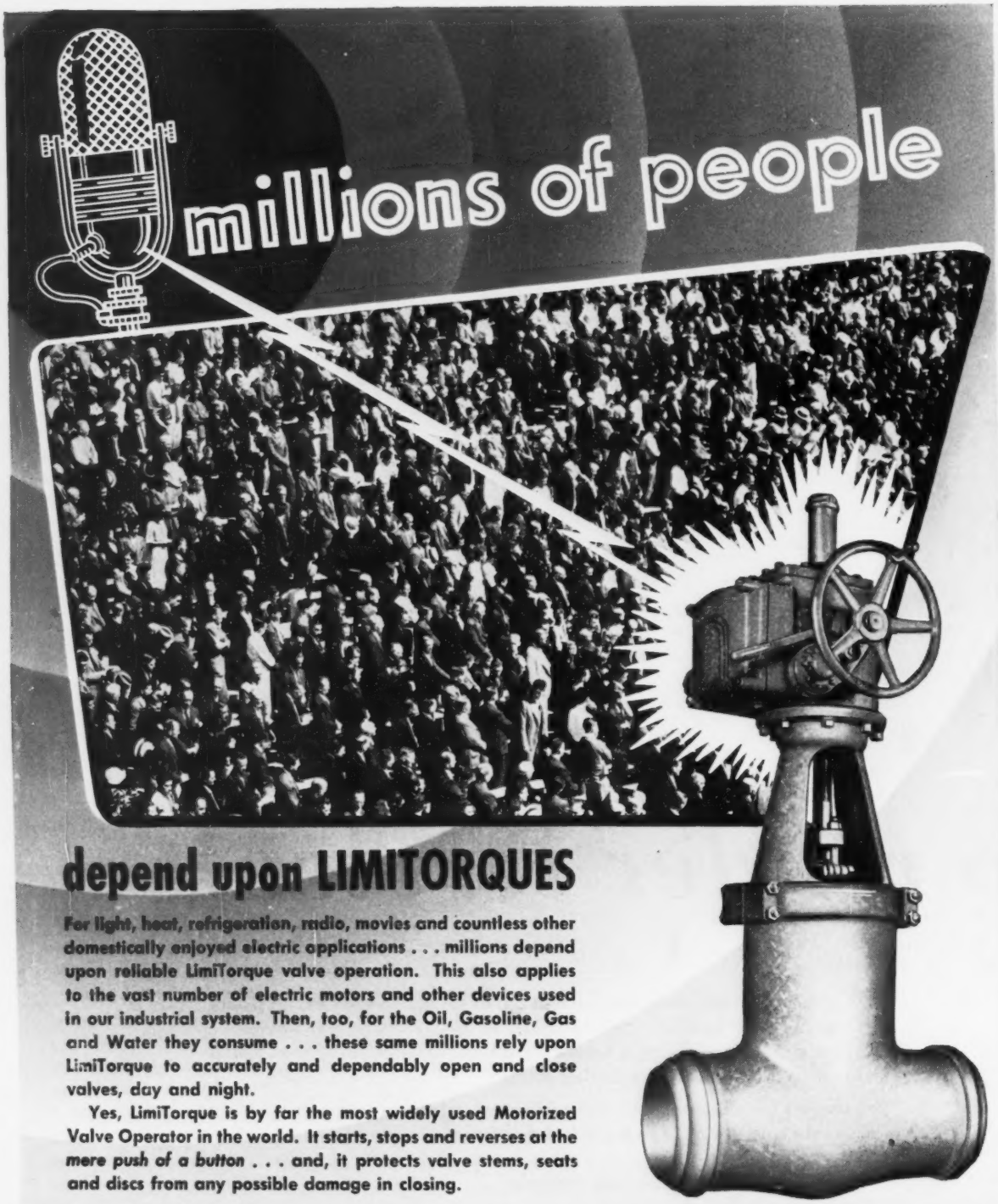
Executive Offices: 420 Lexington Avenue, New York 17, N. Y. Sales Offices in Principal Cities in the United States.



depend upon LIMITORQUES

For light, heat, refrigeration, radio, movies and countless other domestically enjoyed electric applications . . . millions depend upon reliable LimiTorque valve operation. This also applies to the vast number of electric motors and other devices used in our industrial system. Then, too, for the Oil, Gasoline, Gas and Water they consume . . . these same millions rely upon LimiTorque to accurately and dependably open and close valves, day and night.

Yes, LimiTorque is by far the most widely used Motorized Valve Operator in the world. It starts, stops and reverses at the *mere push of a button* . . . and, it protects valve stems, seats and discs from any possible damage in closing.

Philadelphia Gear Works, INC.

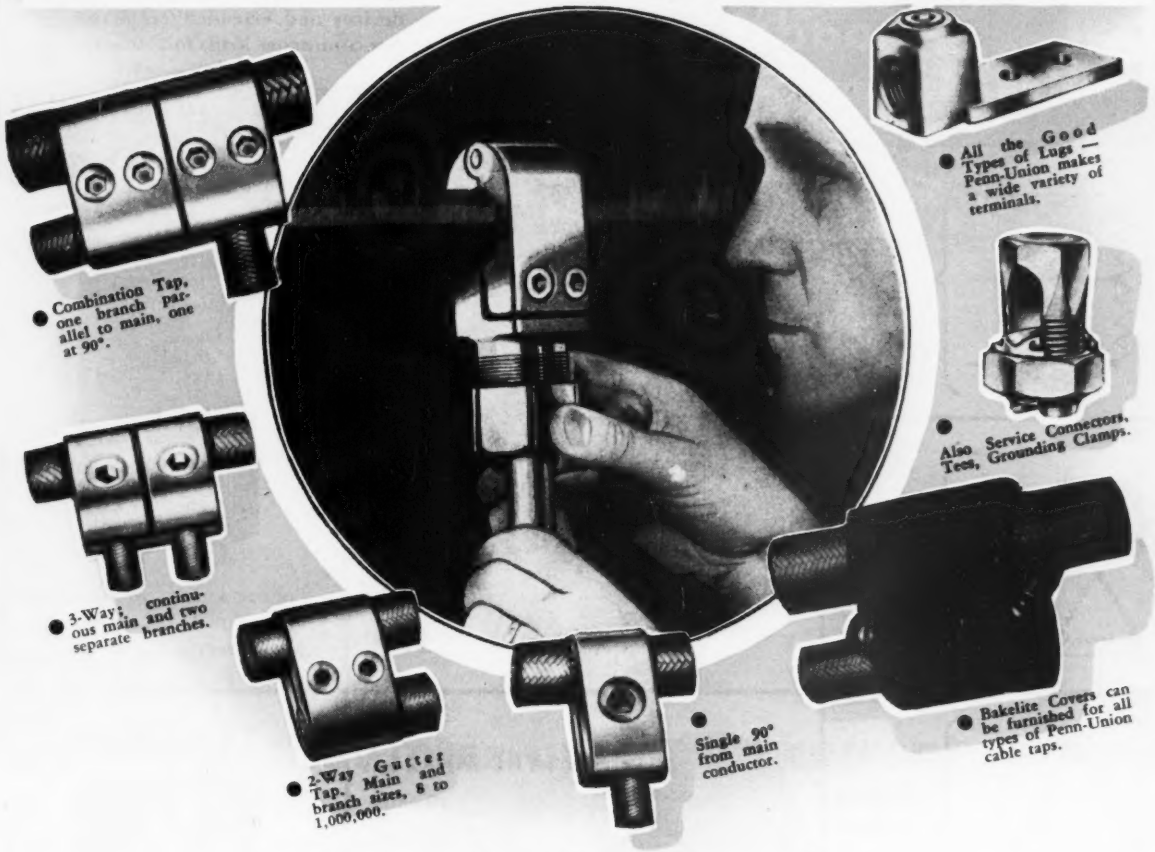
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

PENN-UNION ELECTRIC CORPORATION, ERIE, PA.

It's easy to pick the right CABLE TAP-


● Combination Tap, one branch parallel to main, one at 90°.
● 3-Way; continuous main and two separate branches.
● 2-Way Gutter Tap. Main and branch sizes, 8 to 1,000,000.
● Single 90° from main conductor.
● All the Good Types of Lugs — Penn-Union makes a wide variety of terminals.
● Also Service Connectors, Tees, Grounding Clamps.
● Bakelite Covers can be furnished for all types of Penn-Union cable taps.

from the Complete line

You'll find the widest variety of parallel and 90° taps, combinations, and gutter taps—in a range of sizes up to 1,000,000 cm. Insulating Bakelite covers can be furnished for all types.

Also a complete line of Service Connectors, Terminals, Tees, Straight and Parallel Connectors, Grounding Connectors, etc.—every good type of conductor fitting. And every one is thoroughly tested — *dependable.*

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PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

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250 Richmond St. West, Toronto

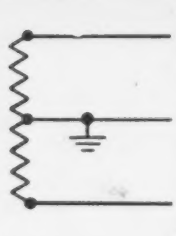
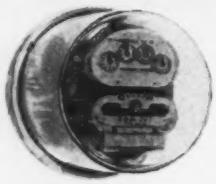
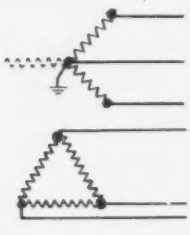
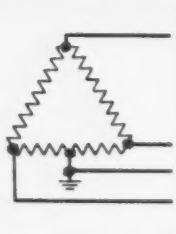
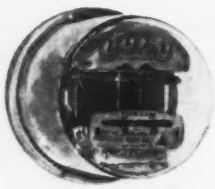
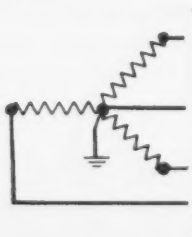
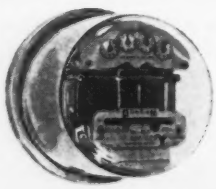
THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

METERS for Tomorrow's Loads!

Industry figures show that total energy sales are approximately doubling every eight years. Meters that are adequate for today's loads must take these increases into account.

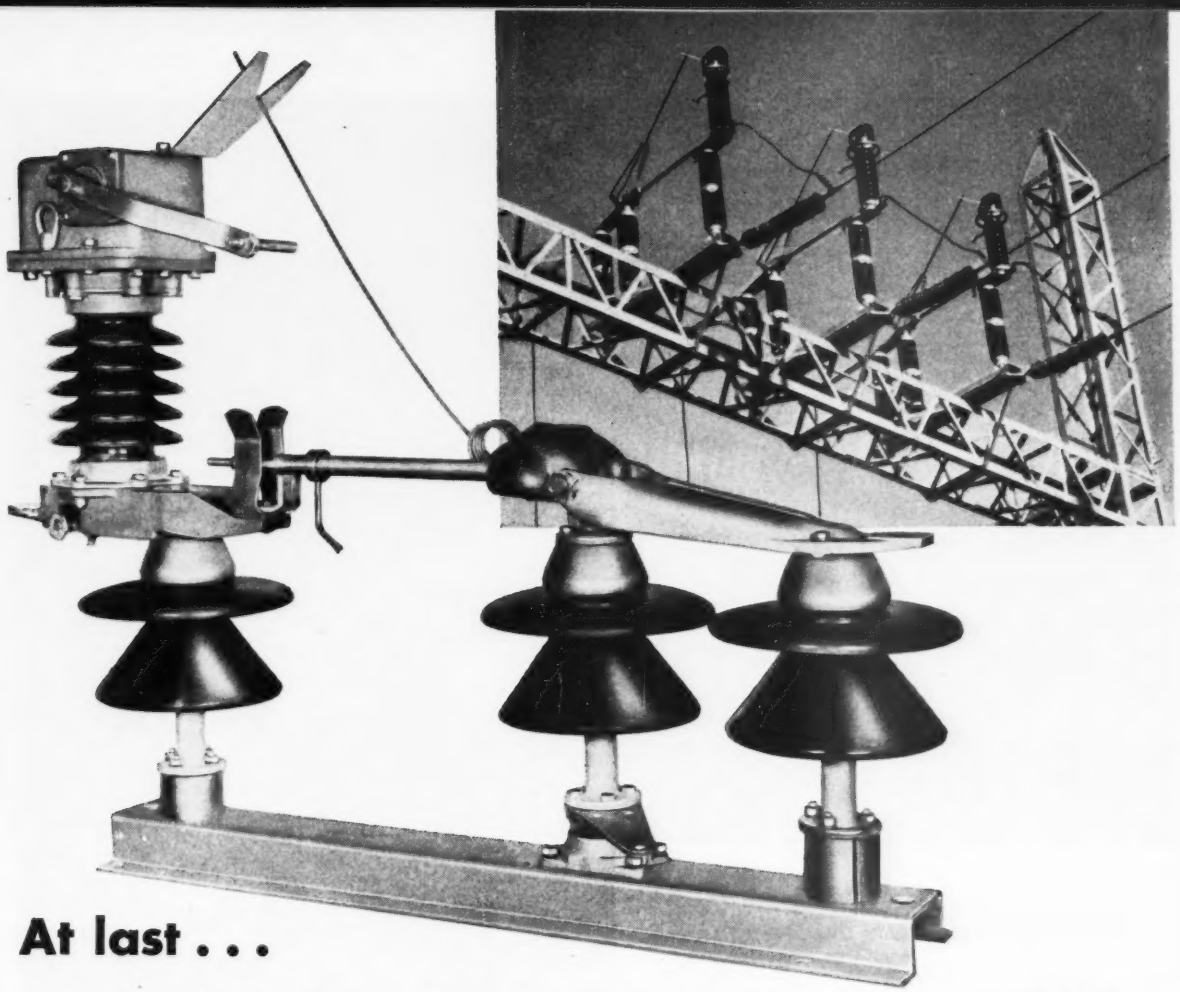
Duncan now has available a complete line of heavy duty metering equipment with adequate capacity to handle these increasing loads—both mounting devices and extended range socket type meters for continuous loads to 200-amperes.

SERVICE	EXTENDED RANGE METERS	HEAVY DUTY DEVICES
 single-phase, 3-wire	 **TYPE MF-SE** 50-amp. 240-volt 3-wire 1-element	**TYPE HD-5** For use with 4- or 5-terminal meters on 1-, 2-, or 3-phase, 3-wire services.
 2-or 3-phase, 3-wire	**TYPE MH-2S** 50-amp. 120-, 240-, 480-volt 3-wire 2-element	
 3-phase, 4-wire delta	 **TYPE MH-2S△** 50-amp. 240-volt 4-wire 2-element	**TYPE HD-7** For use with 7-terminal meters on 3-phase, 4-wire services.
 3-phase, 4-wire wye	 **TYPE MH-2½S** 50-amp. 120-volt 4-wire 2-element	

"Designed for the Service!"

DUNCAN

DUNCAN ELECTRIC MFG. CO.
LAFAYETTE INDIANA



At last . . .

a switch that interrupts load current safely!

Exclusive Westinghouse VLB Switch can reduce switching costs—Now you can use the inexpensive Westinghouse VLB Switch to interrupt load currents on high-voltage transmission lines. The arc is completely enclosed so that it *cannot* develop into a system fault—a distinct possibility if horn-gap switches are used for interrupting duty (a job for which they're not designed).

Interrupts 600 amps—The VLB interrupts line-charging current, transformer magnetizing current or up to 600 amps of load current. Dependable performance under all these conditions provides the basis for interrupting rating.

New interrupter—The problem in designing the VLB Switch was to develop a small but effective interrupter to add to the standard air break switch. It was solved by using a gas, sulfur hexafluoride, which has exceptional arc-extinguishing properties.

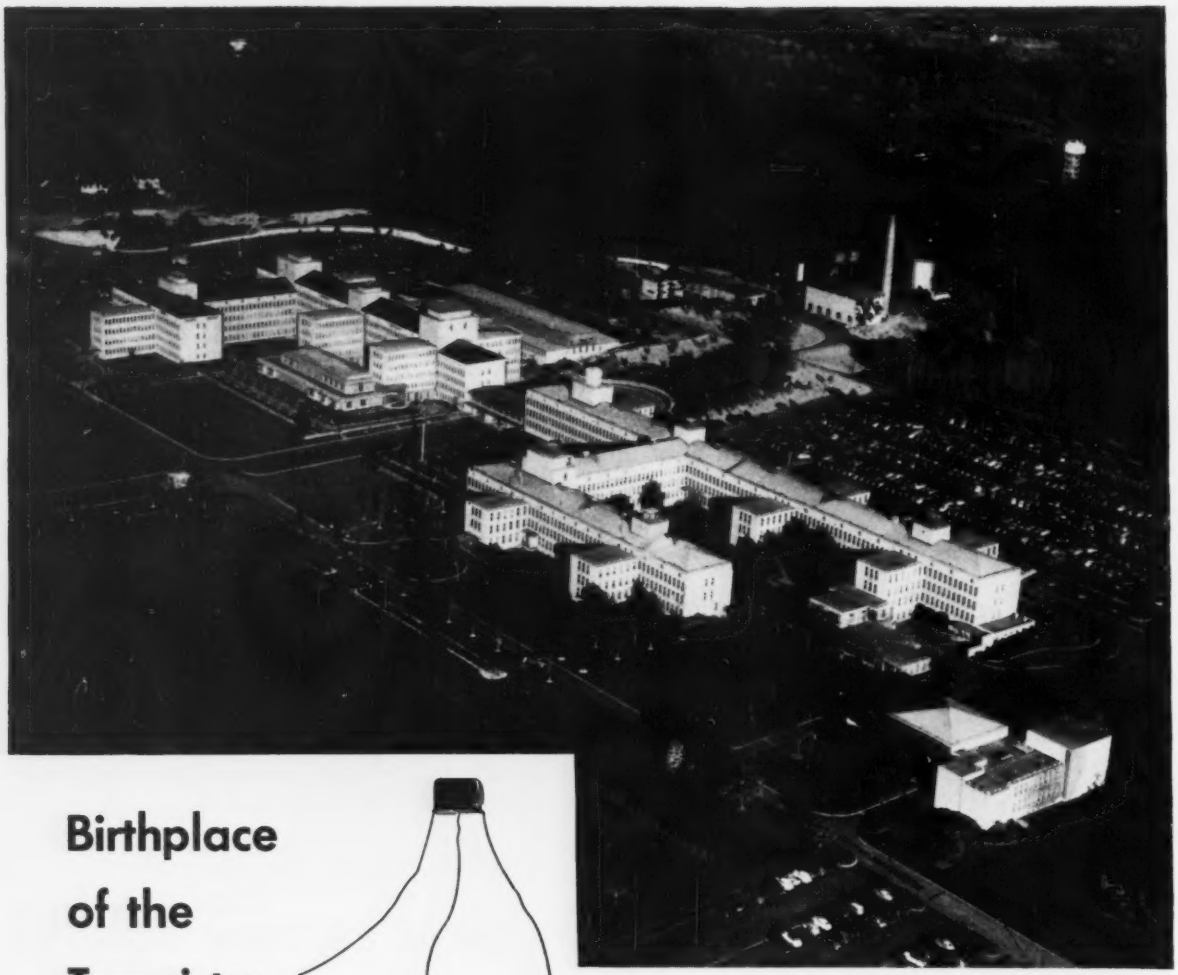
No gas loss—This switch may be operated like a conventional disconnecting switch. When the main blade is raised, the current is carried through the interrupter. The blade engages an arm on the interrupter unit which trips a toggle and snaps open the contacts. The interrupter is hermetically-sealed and no gas is consumed during operation, nor does it deteriorate.

Thoroughly tested—Exhaustive laboratory tests of the VLB show that it is a NEMA Class A device and will operate 500 times without maintenance. Field tests have confirmed laboratory findings.

Replaces air switches—The new switch is available in ratings from 7.5 to 115 kv (138 kv effectively grounded). It can replace existing air switches. Write now for descriptive information on this new device that makes an air break switch do what you have always wanted. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60847

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Birthplace of the Transistor

Bell Telephone Laboratories at Murray Hill, N. J. Other laboratories are in New York City and at Whippany and Holmdel, N. J.

The ***Transistor,*** that revolutionary new electronics device, is a product of *telephone* research. It was conceived, invented and developed at Bell Telephone Laboratories by men in search of ways to improve telephone service. It was announced just five years ago.

The ***Transistor*** can do most of the things that vacuum tubes can do—and others, too—but it is not a vacuum tube. It works on entirely new physical principles. Rugged, simple and tiny, the Transistor uses incredibly small amounts of power—and then only when actually operating.

Transistors promise smaller and cheaper electronic equipment and the spread of electronics where other equipment has not been able to do the job as economically. They are already at work in the Bell System, generating the signals that carry dialed numbers between cities, and selecting the best route for calls through complex switching systems. Engineers see many other possibilities: for example, as voice amplifiers in telephone sets to aid the hard of hearing, and as switches.

Recognizing the tremendous possibilities of the ***Transistor*** in every phase of the electronics industry, the Bell System has made the invention available to 40 other companies. Thus, again, basic research to improve telephony contributes importantly to many other fields of technology as well.

TRANSISTOR SUMMARY

Basically, a ***Transistor*** is a tiny wafer of germanium with three electrodes, over-all about the size of a coffee bean.

It can amplify signals 100,000 times on much less power than a pocket flashlight requires. This opens the door to its use in smaller telephone exchanges where vacuum tube equipment would be too costly to operate.

Unlike a vacuum tube, the ***Transistor*** has no vacuum and no filament to keep hot. It operates instantly, without "warm-up" delay. The Transistor can also be used as an electric eye and to count electrical pulses.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.

Partial Assemblies Courtesy of Hermetic Seal Products Co.

Now 4 D-H Special Alloys Cover Most Glass-to-Metal Sealing Needs

From a single source, the Driver-Harris Company, you can now obtain metal alloys to meet your glass-to-metal sealing needs for both *hard* and *soft* glass.

NEW ALLOY THERLO* This cobalt, nickel iron alloy, possesses ideal properties for sealing hard or thermal shock resistant glass. It matches such commercial hard glasses as Corning 7052 and 7040 in expansivity from 80°C to the annealing point. It produces a permanent vacuum-tight seal with simple oxidation procedure and resists attack by mercury. Readily machined and fabricated, it can be welded, soldered or brazed.

DRIVER-HARRIS 142 ALLOY contains 42% nickel. This is the standard alloy for sealing into sealed beam auto lamps using Corning 776 glass. Used with a borated copper coating, it is the accepted seal for incandescent lamps and radio tubes and matches 8160 glass.

DRIVER-HARRIS 52 ALLOY contains 50% nickel. It provides a slightly higher coefficient of expansion than the D-H 142 alloy and seals successfully with 0120 glass.

DRIVER-HARRIS 146 ALLOY contains 46% nickel. It offers special expansion properties, which permit seals with ceramic coated materials as shown above.

Manufactured to the same high standards that have made Driver-Harris the leader in special purpose alloys for more than 40 years, these alloys are available as rod, wire, strip, sheet foil—and in special shapes. They enable you to meet your specific sealing needs from a single source — so why not consult us today.

*T.M. Reg. U. S. Pat. Off.

Also sole producers of Nichrome*, Advance* and Karma*

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

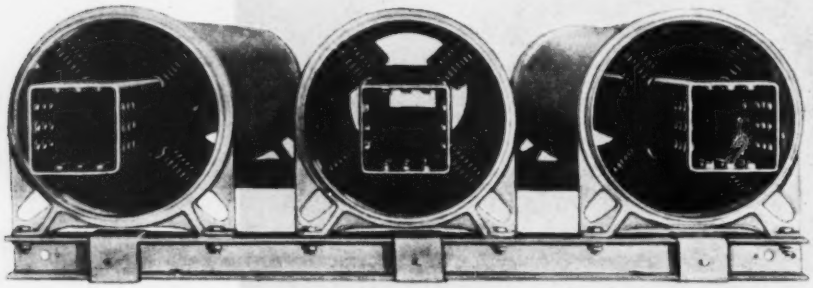
In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

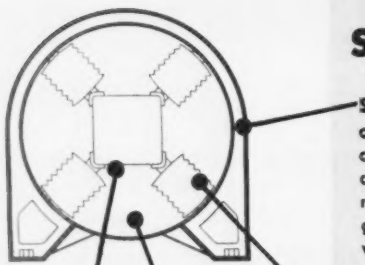
MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

What Isolated Phase Bus is

Transmitting huge quantities of electrical energy at generated voltage is a job for an especially reliable type of conductor. Generator leads, transformer leads, feeders, and main and transfer buses in generating and distribution stations form key links in the nation's power networks. They must possess high dielectric and mechanical strength.

I-T-E Isolated Phase Bus is designed to meet all these electrical and mechanical essentials. It is a structure of heavy copper conductors, one to a phase, each enclosed in its own grounded metal shield. This basic design characteristic completely eliminates phase-to-phase faults in the most economical way possible.





Simplicity is the keynote

SUPPORTING RINGS of strong cast aluminum connect the light metal cover electrically and mechanically to grounded plant steelwork. Tightly gasketed aluminum covers make a single design suitable for indoor or outdoor use.

CONDUCTORS— one for each phase— are of copper or aluminum in round or square cross-section. Lengths up to twenty-four feet are joined end to end with solid, flexible, or braided connectors.

AIR SPACE insulation is unchanged by heat or age. Because air is free and inexhaustible, it does not have to be replenished or kept under pressure.

INSULATORS are of solid, non-aging porcelain, radially disposed to withstand compression. Insulators cradle conductors to allow free movement when conductors expand or contract.

The construction of I-T-E Isolated Phase Bus is as simple as its neat appearance suggests. Complete phase isolation—the fundamental requirement—is achieved through the arrangement and construction of conductor, insulator, and housing.

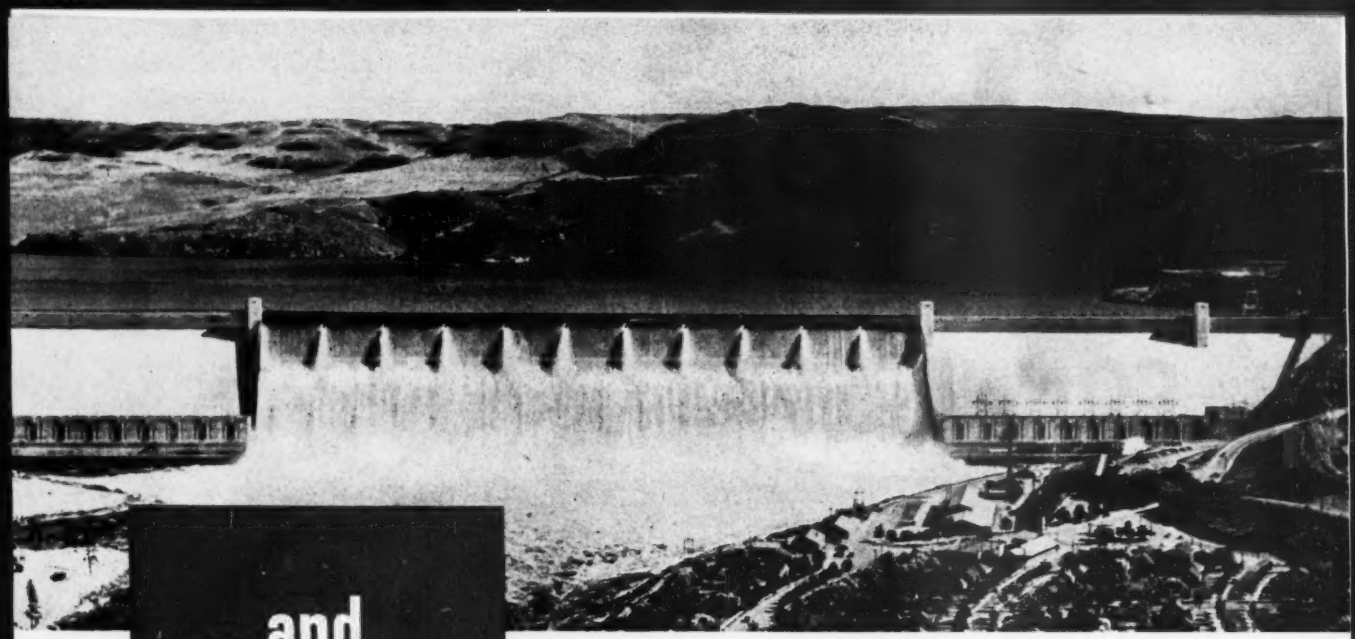
Light weight, freedom of movement for conductors, adequate cooling, and other requirements are provided for through use of a few simple parts.

For details, check the I-T-E Application Engineer nearest you.

ISOLATED PHASE BUS

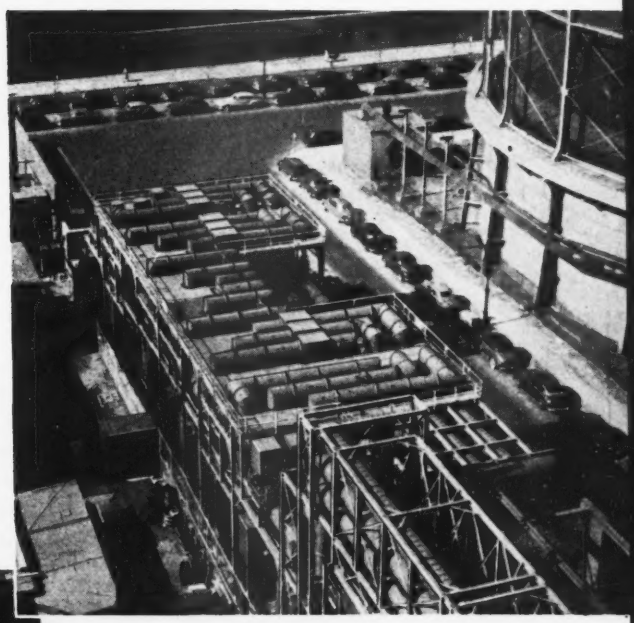
I-T-E CIRCUIT BREAKER CO. • 19th and HAMILTON STS. • PHILA. 30, PA.

R&IE EQUIPMENT DIVISION, GREENSBURG, PA.

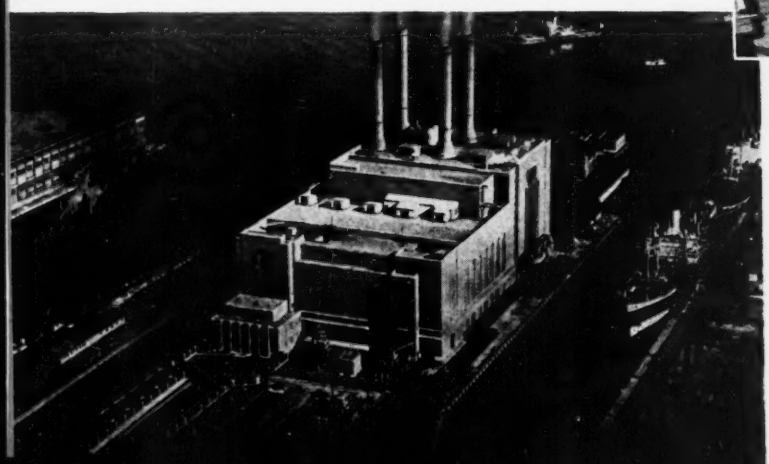


...and where it is used

Hydroelectric generators—
including the world's largest waterwheel-driven machines, deliver vast quantities of power through safe I-T-E Isolated Phase Bus runs.



Steam plants—
are being built with larger and larger generators. I-T-E has design experience and production facilities to keep pace with the nation's expected power expansion and with rapid increases in generator output ratings.



Switching stations—
of the most modern types use I-T-E Isolated Phase Bus runs to connect transformers and distribution switchgear. The installation pictured here employs 69-KV bus structures at a utility central station.

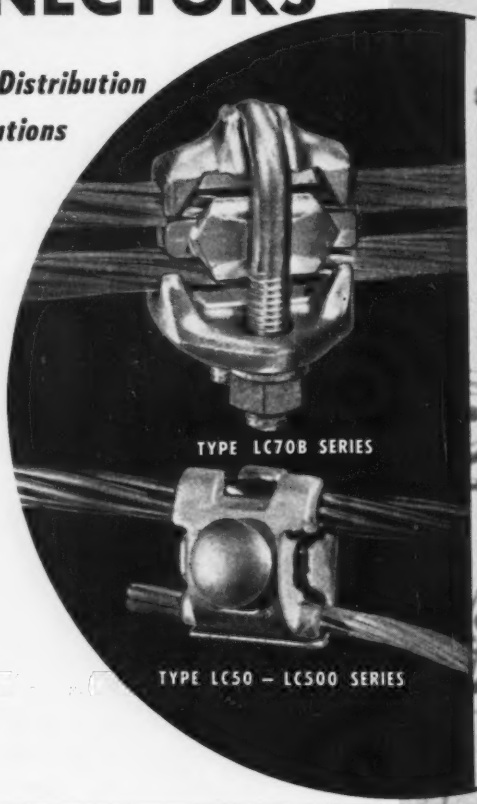
New

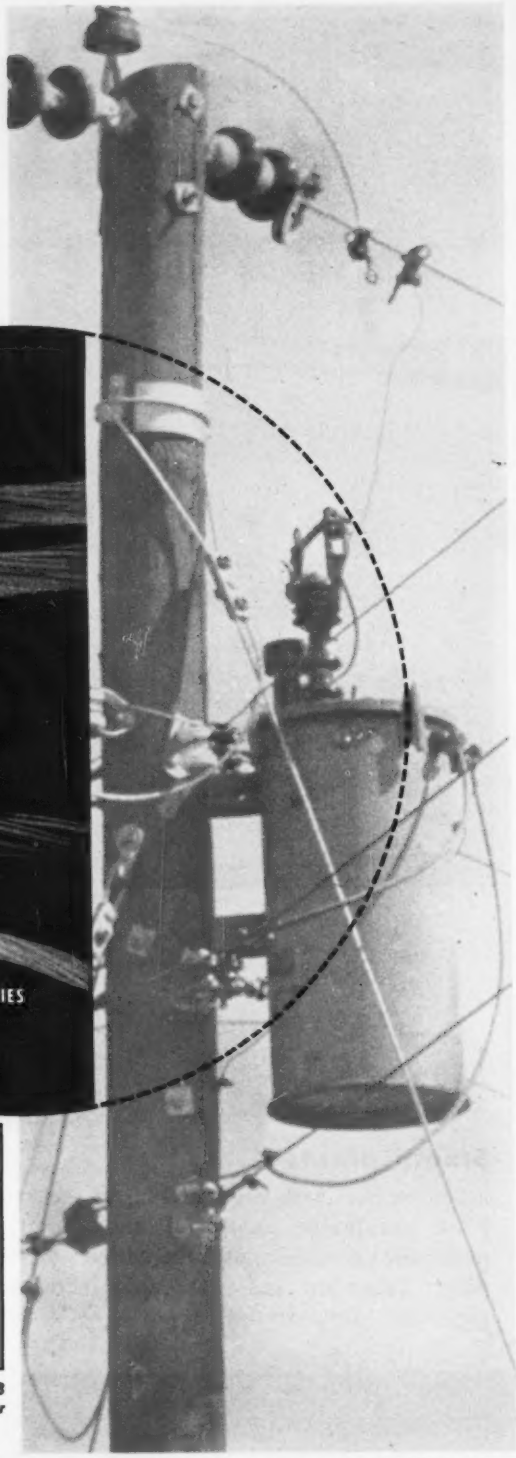
Anderson

TYPE LC50 – LC500 – LC70B SERIES

ALUMINUM CONNECTORS

For Wider Aluminum Distribution System Applications





- ***Inventory Reduced*** – Increased range, fewer connectors to stock, less cost.
- ***Dependability Assured*** – For more than a quarter century a leader in engineering and manufacturing aluminum connectors.
- ***Controlled Quality*** – From ingot to finished product.

CATALOG NUMBER	MAIN	TAP
LC-51A	#6–1/0 ACSR	#6–#2 ACSR
LC-52A	#6–1/0 ACSR	#6–1/0 ACSR
LC-511A	#6–1/0 ACSR	#8–#2 COPPER CABLE
LC-522A	#6–1/0 ACSR	#8–1/0 COPPER CABLE
LC-70B	#6–#2 ACSR	#6–#2 ACSR
LC-71B	#6–1/0 ACSR	#6–1/0 ACSR

Consult one of our nearest 18 representatives or contact our main office.

Aluminum and Bronze
POWER CONNECTORS
•
CLAMPS
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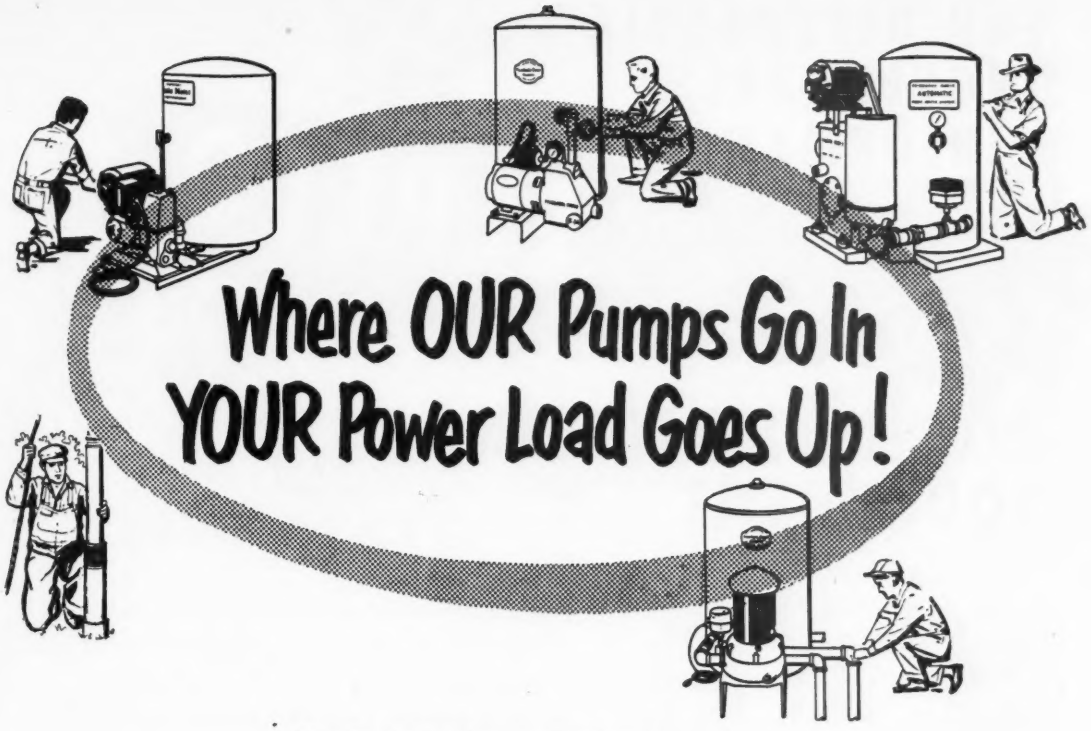
FITTINGS *and*
ACCESSORIES *for*
SUBSTATION — TRANSMISSION — DISTRIBUTION

'ABW

Anderson Brass Works
INCORPORATED
BIRMINGHAM 1, POST OFFICE DRAWER 2121 ALABAMA



Where OUR Pumps Go In YOUR Power Load Goes Up!

Usually the first home utility bought by a new high line customer is an electric water system.

With this basic utility installed in the home, a woman becomes the world's best prospect for many other load-building appliances—

a water heater, washer dryer, ironer; garbage disposal unit, an electrically-controlled heating system, and an automatic dish washer.

Her husband also buys load-building appliances. Often he installs a water heater in the milk house before his wife enjoys one in her home. He buys electrically operated water tank heaters and automatic waterers. And he may even install a *second* electric pump for farm operations only!

FAIRBANKS-MORSE

a name worth remembering when you want the best

WATER SYSTEMS • GENERATING SETS • MOWERS • HAMMER MILLS • PUMPS
MAGNETOS • MOTORS • SCALES • DIESEL LOCOMOTIVES and ENGINES

What you ought to know about our water systems

Since electric water systems are *big* factors in helping you build up power loads, you ought to know all about them. So we've thought of ways to help you. First, we'll be glad to supply you with educational wall chart selection guides, and booklets showing types of pumps, their capacities and uses. Second, we'll loan you slide films showing installations of a new submersible pump. For complete details, mail the coupon!

Fairbanks, Morse & Co.
600 S. Michigan Ave., Chicago 5, Ill.

Please send a representative to show us how to use your wall charts and interpret your literature on home water systems.

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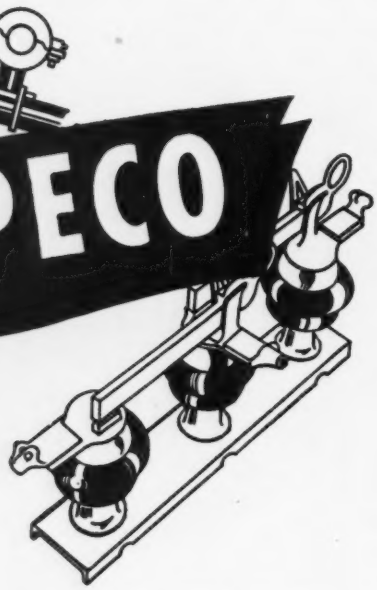
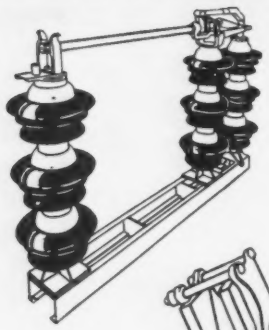
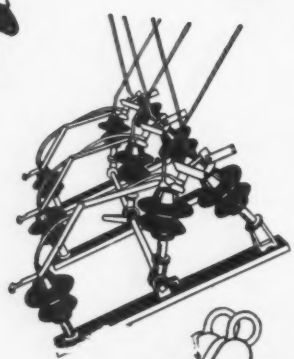
FOR DEPENDABLE TROUBLE-FREE PERFORMANCE

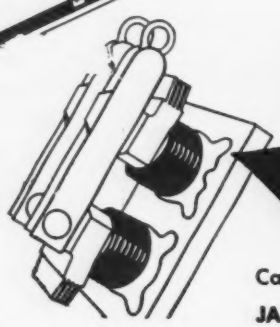
Install ELPECO



POWER SWITCHING EQUIPMENT







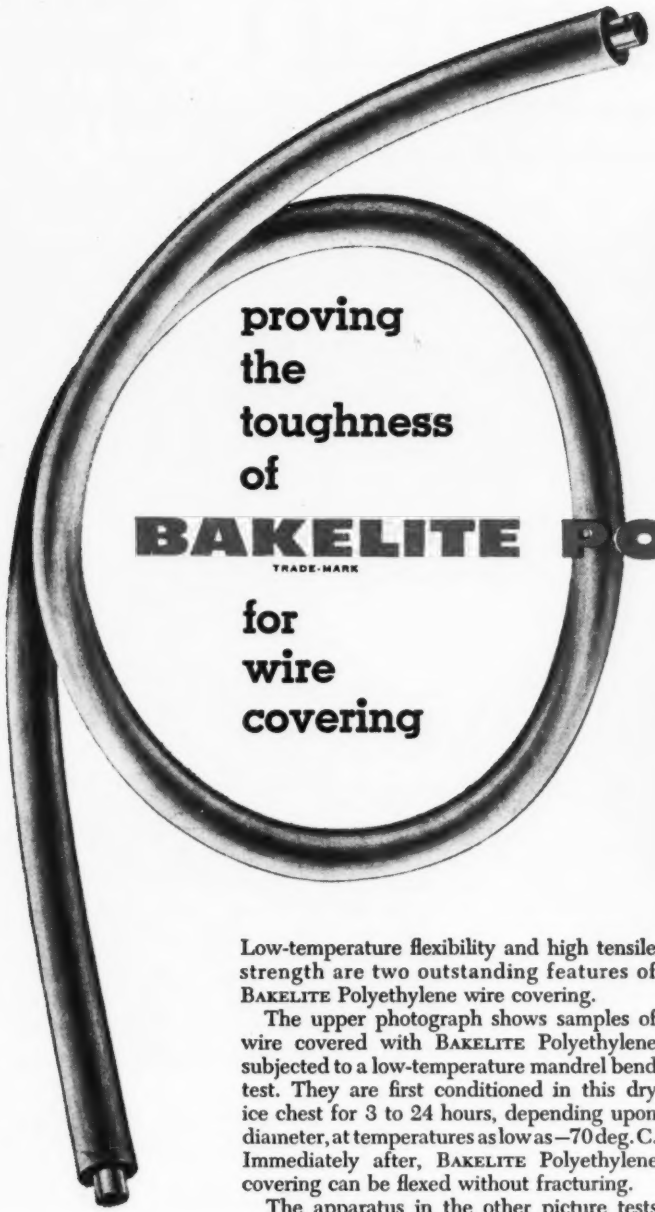
For over 40 years the Elpeco line of high-quality power switching equipment has been known for its outstandingly dependable and trouble-free performance. Constant research and redesign have enabled Elpeco to *anticipate* rather than meet the ever changing demands and requirements of the electrical industry. Particular buyers, who have specified Elpeco products over the years, know that when they buy Elpeco Indoor and Outdoor Disconnect Switches, Air Break Switches, Indoor and Outdoor Bus Supports, Bus Ducts and Substations . . . they are getting the finest, most modern equipment on the market. All Elpeco products conform to NEMA and AIEE standards for performance.

A new series of bulletins, completely illustrating and describing each item in the Elpeco line is now available. Let us know the particular type of equipment in which you are interested. We'll be glad to send the appropriate bulletins by return mail.

ELPECO

DIVISION OF ROLLER-SMITH CORP.
BETHLEHEM, PENNA.

Canadian Affiliate:
JAMES R. KEARNEY CORP. of Canada, Limited, Guelph, Ontario

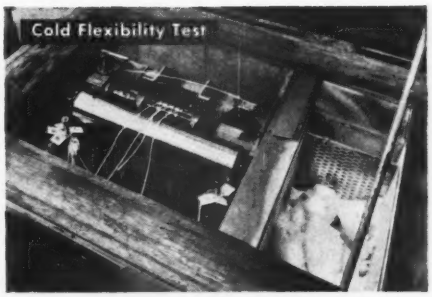


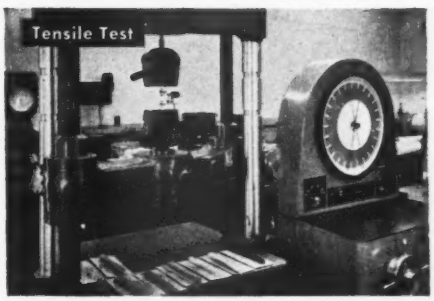
proving the toughness of

BAKELITE POLYETHYLENE

TRADE-MARK

for wire covering





Low-temperature flexibility and high tensile strength are two outstanding features of BAKELITE Polyethylene wire covering.

The upper photograph shows samples of wire covered with BAKELITE Polyethylene subjected to a low-temperature mandrel bend test. They are first conditioned in this dry ice chest for 3 to 24 hours, depending upon diameter, at temperatures as low as —70 deg. C. Immediately after, BAKELITE Polyethylene covering can be flexed without fracturing.

The apparatus in the other picture tests samples of BAKELITE Polyethylene, conditioned for 24 hours at room temperature. Average readings show a minimum tensile strength of 1800 psi using molded test bars.

These laboratory tests, as well as actual service in the field, demonstrate the advantages of BAKELITE Polyethylene for wire insulation and covering. It resists weathering, abrasion and chemicals. The approved black compound stays flexible down to —70 deg. C., resists deformation up to 90 deg. C. It meets ASA suggested specifications (second draft; July 20, 1952) for weather-resistant wire and cable.

BAKELITE Polyethylene, with a specific gravity of only 0.94, provides lighter weight, makes stringing easier. Its excellent electrical properties permit its use as thinner wire covering that speeds stripping and splicing. Extruded over wire and cable, BAKELITE Polyethylene *won't festoon.*

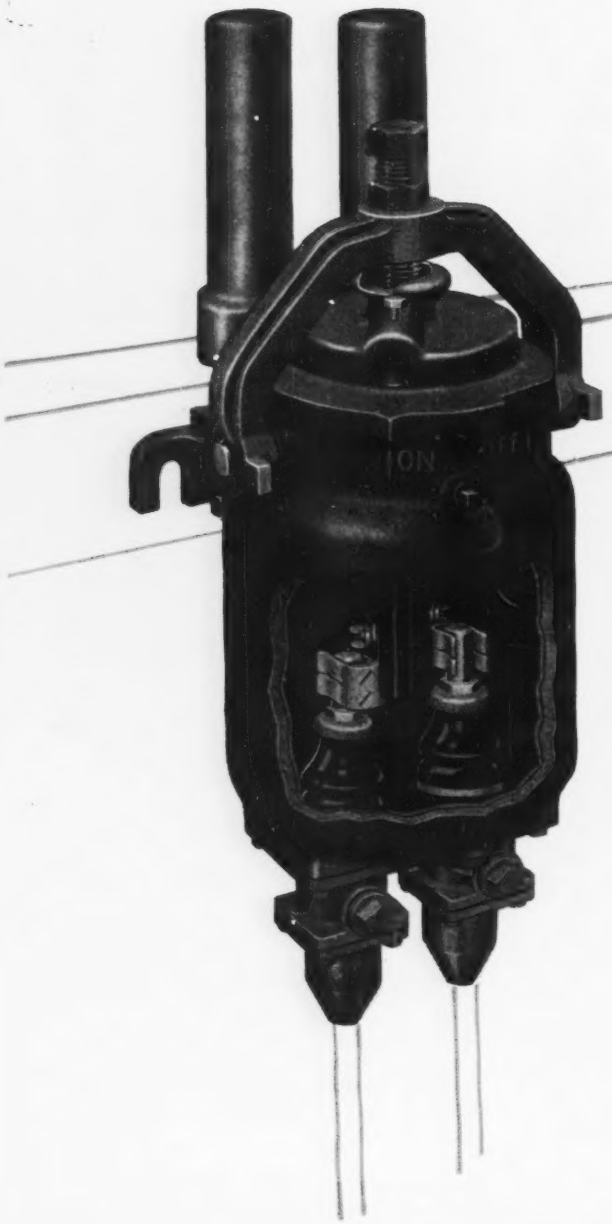
Compare the properties of BAKELITE Polyethylene with those of any other line wire covering. Get your free copy of Kabelitems No. 48, which gives detailed information. Write Dept. RA-63.

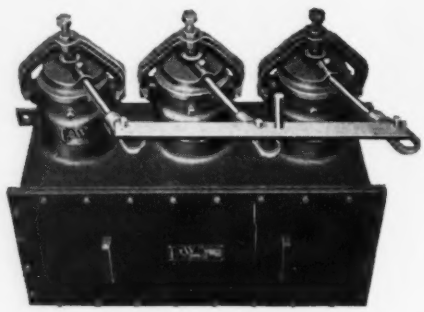
BAKELITE
TRADE-MARK
Polyethylene
WIRE COVERING

OUTSTANDING ELECTRICAL PROPERTIES (black compound) for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C., power factor is only 0.004; dielectric constant is 2.5. These values hold through the range from 60 cycles to 5 x 10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE Polyethylene excels in resistance to voltage breakdown, even after long-time water immersion.

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.
In Canada: Bakelite Company (Canada) Ltd., Belleville, Ontario

CAST STEEL TANK (HERMETICALLY SEALED—OIL FILLED) PROTECTS MEN AND EQUIPMENT BY SAFELY WITHSTANDING HIGH PRESSURES OF HIGH VOLTAGE FUSE CLEARING A HEAVY SHORT CIRCUIT





"FC" OIL FUSE CUTOUTS

2500 — 5000 — 8000 VOLTS

In addition to the main purpose—a pressure tight enclosed fuse—the device serves as a full load break oil switch. The gang operating mechanism provides for three phase sectionalizing. The switching contacts are Beryllium copper. Fuse links are simple and inexpensive, easily replaceable in the carrier on the removable cover of the cutout tank.

Welded steel boxes with cutouts on top, enclose connections to feed and load circuits.

Bulletin CA52 gives data and prices. Write for a copy or ask your representative.

G/W "Forethought" CD1-S shows how "FC" cutouts are combined with "RAL" oil switch. Send for your copy, there is no obligation.

G & W ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U.S.A.

In Canada—Powerlite Devices, Ltd., Toronto and Montreal

THERE'S A KAISER ALUMINUM EC DISTRIBUTOR CONVENIENTLY LOCATED TO SERVE YOU

Line Material Company
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Virginian Electric, Inc.

Take advantage of the many services **offered by your nearby Kaiser Aluminum ECDistributor. Here are a few:**

- He has available large stocks of Kaiser Aluminum Conductor.
- He insures fast delivery to help reduce your inventory.
- His specialized knowledge helps solve your individual problems.
- He provides top-notch engineering services.
- He keeps you abreast of latest developments and techniques.
- He gives you friendly, personal attention on any size order.

NEOPRENE AND POLYETHYLENE COVERED CONDUCTOR, SOLID AND STRANDED • SELF-SUPPORTING TRIPLEX CABLE • ACSR ALL ALUMINUM CONDUCTOR

Kaiser Aluminum

setting the pace—in growth, quality and service

Maximum Per

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Milwaukee 1, Wisconsin

Return Dollar Invested

Corona-Free Transformers Stay Young Longer

Allis-Chalmers power transformers, thanks to their corona-free design, will produce profits on your system far longer than any transformer not thoroughly protected from the dangerous effects of corona.

How Insulation Design Helps Eliminate Corona

Insulation design reduces effect of concentrated dielectric fields. Danger from dielectric stress is reduced by placing insulation next to critical areas and by shaping insulation surfaces.

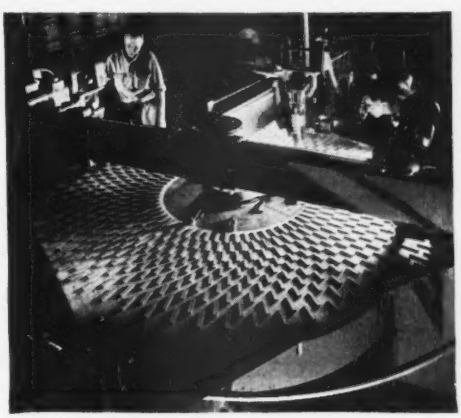
Proof of corona-free design comes when engineers use such tools as calculating boards, surge generators, and oscillographs to test for corona. These tests tell why it pays to install corona-free power transformers.

A-4016

Case Study in Improved Production Procedures

You get greater cooling efficiency from Allis-Chalmers power transformers thanks to the unique machine shown here. It fastens tens of thousands of spacers to the fuller board washers used in insulating transformers. The machine works quickly and precisely. There is no possibility that any of the thousands of spacers will be misplaced or improperly attached. This is quite a contrast with the days of painstaking manual labor the job used to require.

Within a few minutes one of the huge fuller board washers is placed in position and indexed. The machine then fastens each spacer separately and presses it into position. This machine is a good example of new machinery constantly being developed and manufactured in Allis-Chalmers extensive tool works. It's an important reason why you get the best workmanship and results when you specify Allis-Chalmers transformers.



In Fifty Countries . . .

BALDWIN TURBINES develop over 5,000,000 h.p.

No matter what your power plant requirements might be, there are four important reasons why you should turn to Baldwin for the answer to your hydro-electric development problems:

1. Baldwin-Lima-Hamilton Corporation has at its disposal a wealth of experience dating back to the early days of the Pelton Water Wheel Co., a present Baldwin subsidiary, and the I. P. Morris Co. which manufactured its first turbine equipment in 1841.
2. They offer you a complete range of available capacities . . . small, fractional horse power water wheels to the largest units that can be shipped.
3. Since their line includes all four basic types of turbines (at left), Baldwin engineers can make an unbiased recommendation of the type best suited for your conditions and needs.
4. Baldwin and Pelton can supply other hydraulic machinery: surge suppressors; butterfly, needle, spherical and relief valves; large capacity low head pumps.

You'll enjoy and profit from reading Baldwin Bulletin 1000 which devotes all 24 pages to pictures and data on typical Baldwin turbine installations. Please write to Dept. 5007, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN · BLH · LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, • Offices in Principal Cities

Leading from a substation, Hazard self-supporting cable carries power to switchgear in foreground. Cable is 3/C, 350,000CM, Watertite-Hazaprene cabled and bound to Copperweld messenger with a copper binder tape.

delivers the goods

AT ANCHOR ROME TEXTILE MILLS

In a recent modernization at the Rome, Georgia plant of Anchor Rome Mills, Hazard Watertite-Hazaprene Self-Supporting Aerial Cable was used. Here, you can see the extreme flexibility of the installation . . . it can be strung close to buildings and existing structures with complete safety.

The excellent electrical and physical characteristics of Watertite-Hazaprene were important in the selection of power cable at Anchor Rome Mills. Watertite insulation provides the needed moisture and heat resistance with toughness, resilience and high dielectric strength. The rugged, weather-resistant Hazaprene sheath—the same used for Hazard mining cables—assures long-lived dependability.

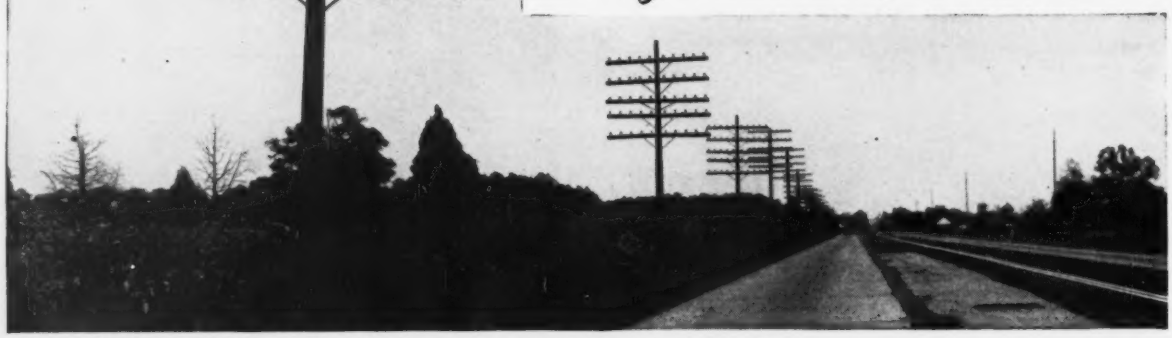
Of additional advantage to industrial installations is the "three-in-one" construction of Hazard self-supporting cable. Pre-assembled cable, messenger and binder provides safety, low cost, quick installation and neat appearance. Relocation, when needed, is a simple operation. Get the complete story on dependable, money-saving industrial aerial power circuits from your Hazard representative or write today . . . Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD **insulated cords and cables**

1443

Here's Proof of Performance...

75% of the Creosoted poles in this line are still in service *after 56 years!*



THESE 56-YEAR-OLD POLES are located along Route 460 between Suffolk and Windsor, Va. They carry an average of 50 wires used for telegraph, radio and long distance circuits.

ONE OF THE OLD POLES raised for greater height. Notice the excellent condition of the Creosoted pole after years of use.

●Erected in 1897, these poles are a part of what is reported to be the oldest telephone line in service in the country—between Richmond and Suffolk, Va. One big reason why they are serviceable after 56 years—they're protected by Creosote Oil.

Of the original 3806 poles in the Richmond-Suffolk portion of the line, approximately 2900 are still in service. Inspections take place every four or five years, the last in 1949. At that time only 3% of the poles were marked for replacement in 1953.

A few years ago it became necessary to raise these poles by bolting the original pole to a stub. At that time, portions of the poles that had been underground were found in excellent condition, and capable of many more years of service.

When you use a wood preservative, let service records like this be your guide. They are the important reason why Creosote Oil is the first choice of the electric utility and telephone industries.

And for the finest performance, be sure the wood you use is treated with U·S·S Creosote Oil. It is the product of continuous processing in the world's largest tar distillation plant. For complete information on U·S·S Creosote Oil, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

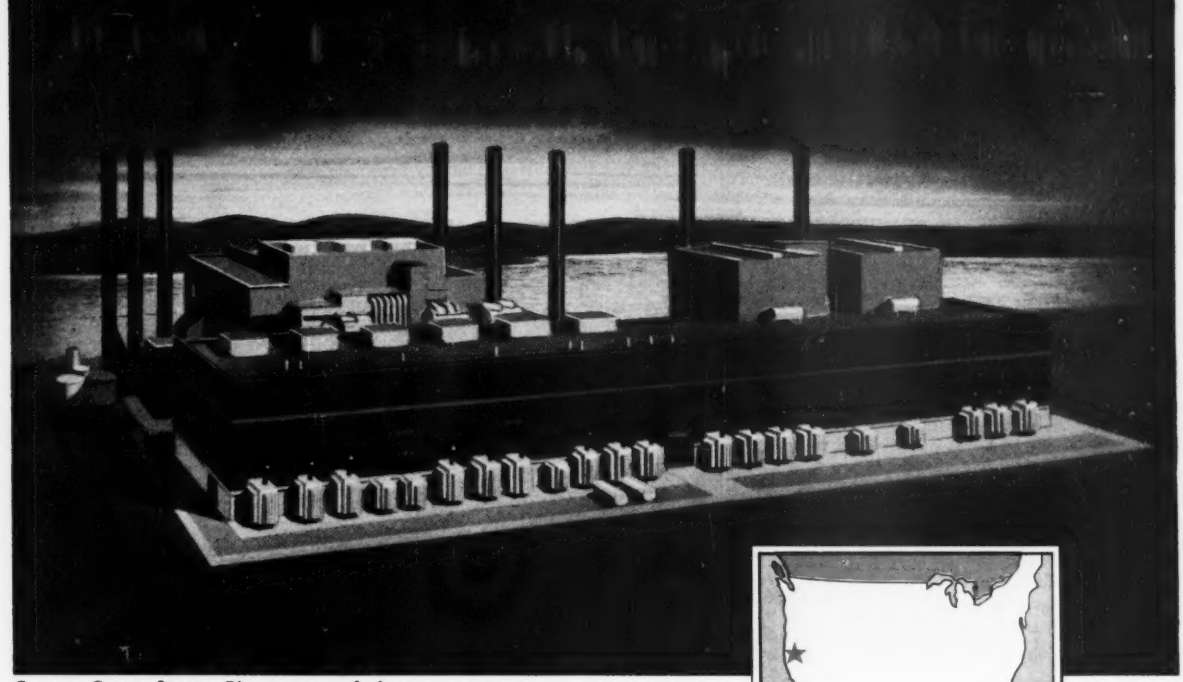
U·S·S CREOSOTE OIL

USS

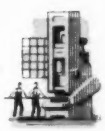
3-493

UNITED STATES STEEL

Complete Responsibility– Anywhere*



Contra Costa Steam Plant, one of the west's largest, went into operation in 1951, is now being expanded.



In California at locations only seven miles apart two steam electric plants are under construction for Pacific Gas and Electric Company. One is rated at 500,000 kilowatts, the other at 600,000. The design and construction of both plants is by Bechtel.

The resources of experience, organization and physical equipment serving these and other power projects are readily available to utility companies contemplating expansion programs . . . of any size, anywhere.

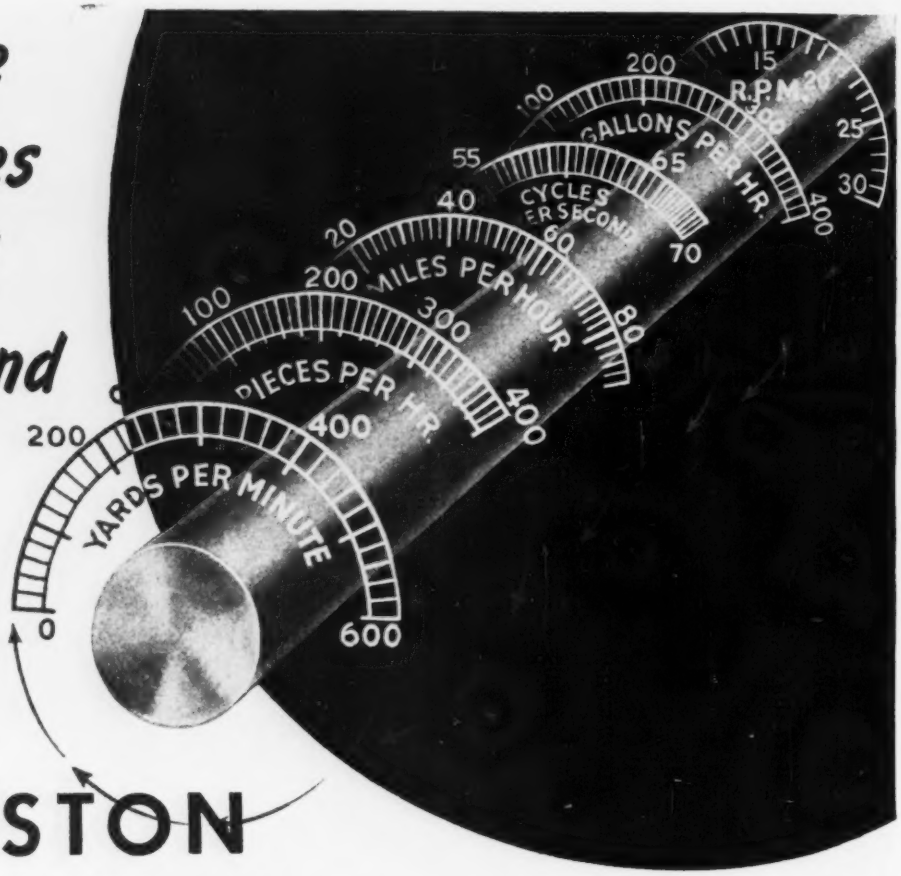
BUILDERS FOR INDUSTRY

BECHTEL

BECHTEL CORPORATION

Los Angeles · **SAN FRANCISCO** · *New York*

If some part goes 'round and 'round



...WESTON *Electrical Tachometers*

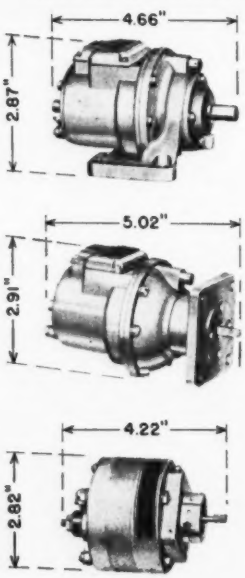
can provide a simple, accurate key to control!

Wherever instant, accurate measurement furnishes the key to precise control, equipment manufacturers now build-in WESTON Electrical Tachometers. For no other method approaches the electrical tachometer for simplicity, ease of installation, overall dependability and ready adaptability to problems of design.

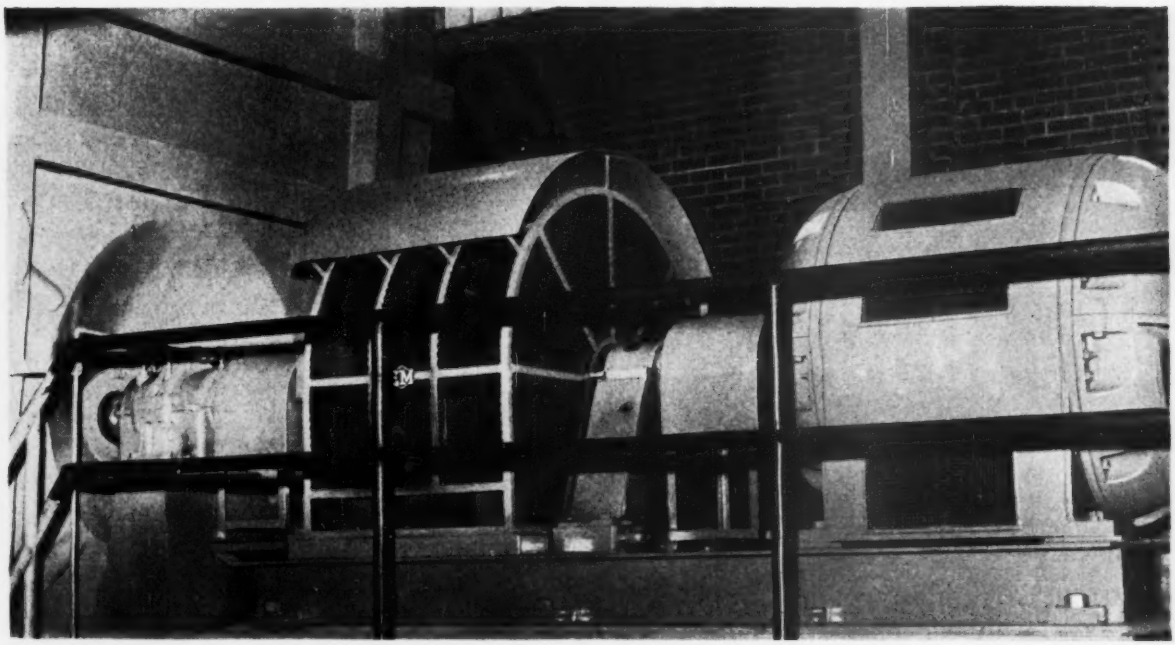
The specially designed WESTON A-C and D-C Tachometer Generators, for example, save up to 50% in size and weight, and are available in forms to permit wide flexibility in mounting, and in connection arrangements. The WESTON Indicators, too, are available in required sizes and shapes, calibrated in any function of the RPM. Available to directly indicate speeds as low as 1/10 RPM up to 80,000 RPM.

Other advantages of electrical tachometers such as . . . multiple indications from one generator . . . remote indications . . . dependable, long-term accuracy . . . and low maintenance, warrant full investigation. Complete details gladly sent on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

Space-saving • Weight-saving WESTON Generators



WESTON *Instruments*



4400-TPA-2118

When You Change Draft Fan Output Do It Quickly...Precisely!

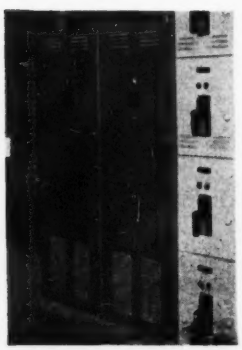
An E-M Adjustable-Speed Magnetic Drive with Regutron Controls gives fast-acting draft fan speed response . . . the quickest, most precise speed control method you can specify for regulating draft fan output to meet varying requirements in your power plant's combustion control system.

At Plant Hagood of the South Carolina Gas & Electric Co. in Charleston, illustrated above, these E-M Magnetic Drives with associated Regutron Magnetic Amplifier Controls respond *unusually fast* to demands for new speeds, altering fan speed in seconds. Special damping and anti-hunt circuits in the "Regutron" Control prevent any overrun on speed changes.

An electromagnetic torque-transmitting device, the E-M Magnetic Drive converts the economical constant speed of an a.c. driving motor into adjustable speed for the fans.

This fast, accurate E-M control of fan speed helps cut down thermal losses and improves combustion. Also, the need for damper controls or inlet vanes on the fans is eliminated. Costly erosion of fan blades is minimized.

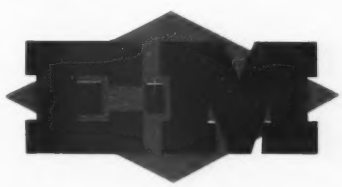
Ask your nearest E-M sales engineer how the Magnetic Drive and Regutron Control can fit in your plant. And write the factory for the publication listed below.



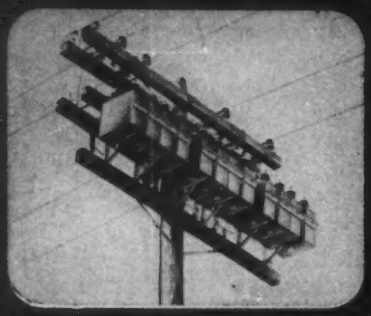
THIS IS THE NEW E-M REGUTRON MAGNETIC AMPLIFIER CONTROL for Magnetic Drive installations. This new simplified control adjusts fan speed accurately to within 0.5% of speed called for by automatic combustion control. A simple saturable core reactor amplifier system accomplishes quick, precise control of speed.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

☐ Send me Publication No. 1107 on Magnetic Drives and Regutron Controls.



Dependable Auxiliary Drives for Power Plants



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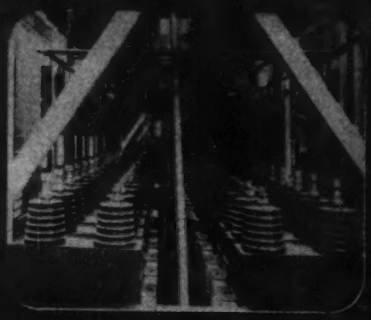
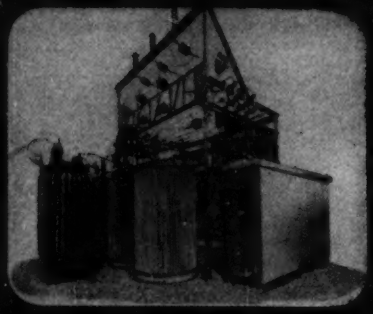


1942



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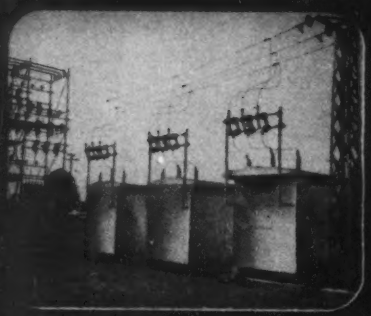

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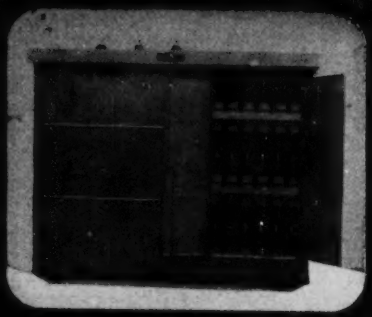

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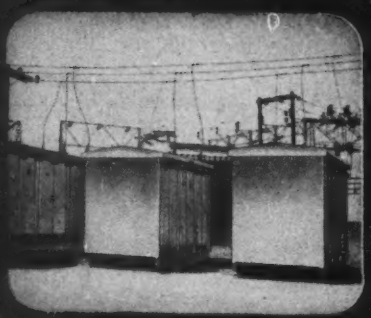

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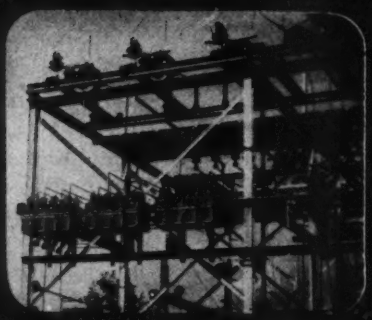

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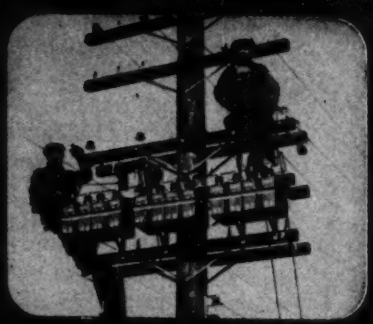

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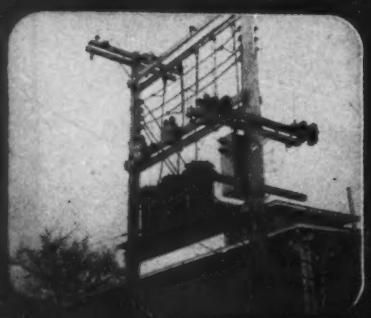

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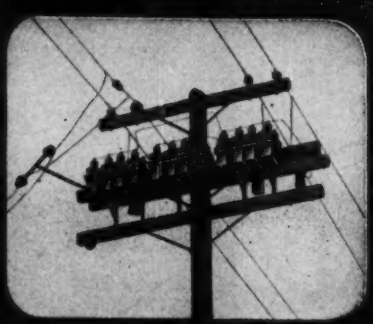

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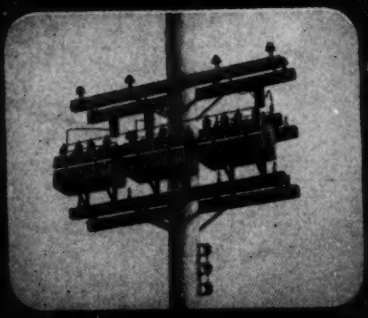

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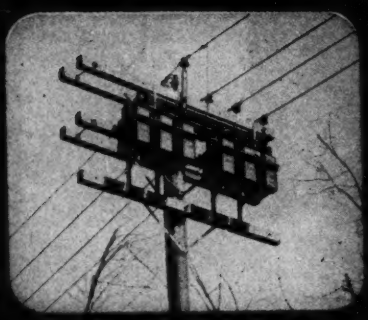

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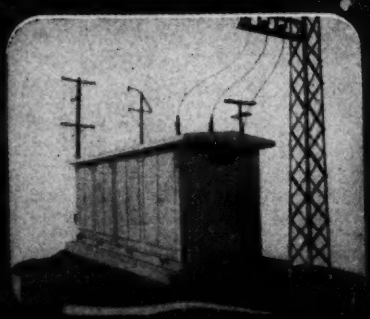


1946

the Years write an impressive testimonial to Cornell-Dubilier Capacitors

You will find them in the stations and on the poles of the country's largest power producers: C-D capacitors that have been in continuous operation since 1938, 1939, 1940 with *little or no maintenance required!* Over 4,000 time-tested C-D installations confirm that this is truly the most *consistently dependable* capacitor for power-factor improvement.

C-D gives you these extra safety factors

- C-D capacitors are designed to withstand transient over-voltages as well as steady state voltages. Low dielectric unit stress provides this extra margin of safety.
- Heavy major insulation in the form of laminated liners with reinforced corners, insures highest impulse withstand levels.
- Only C-D capacitors (from 230 to 13,800 volts), are subjected to a full rated voltage energization test.
- Wide margin between paper and foil provides higher insulation level.
- Use of C-D's Dykanol results in lower unit weight per KVAR; high stability; long life.
- Heavy-Duty wet process porcelain bushings for longer creepage path, less breakage, higher impulse rating.

Planning an installation of industrial, station or pole-type capacitors for power-factor improvement? You can save maintenance dollars and insure trouble-free service by talking it over with a C-D engineer. Cornell-Dubilier Electric Corp., Dept. D-73, South Plainfield, N. J.

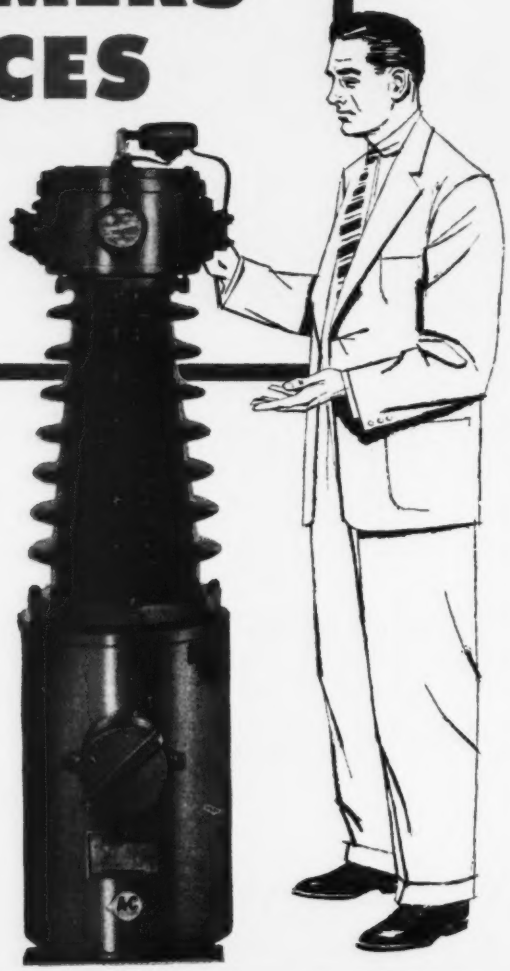
CONSISTENTLY DEPENDABLE

CORNELL DUBILIER CAPACITORS

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, AND CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C.; AND SUBSIDIARY, THE RADIART CORP., CLEVELAND, OHIO

ALLIS-CHALMERS INTRODUCES

New Line of Outdoor Current Transformers



Featuring:

- ★ **Weight Reductions Up to 54% Compared With Previous Designs**
- ★ **High Thermal Rating**
- ★ **Increased Mechanical Strength**
- ★ **Corona-Free Design for Long Insulation Life**

HERE IS A COMPLETELY NEW LINE of current transformers for outdoor use on power circuits 69 kv and below. They bring you many advances, including design features that result in excellent performance, high thermal and mechanical strength, improved insulation life, and mechanical advantages that simplify installation.

Most important, their ruggedness has been proved by exhaustive tests. Temperature rise at normal current is low, allowing ample overcurrent in emergencies. The transformers are rated 65 times normal primary current under short circuit conditions.

For the complete story get your copy of the paper "Progress in Instrument Transformer Design" by writing Allis-Chalmers, Milwaukee 1, Wisconsin. A-4109

LESS WEIGHT — LESS FLOOR SPACE
Compare New Type SCW with Previous Design

Kw	Design	Height	Floor Space	Gal. Oil	Weight (lbs.)
25	New Type SCW	42"	14" x 19"	9	230
	Previous Type	33"	22" x 22"	15	490
34.5	New Type SCW	45"	14" x 19"	9½	230
	Previous Type	33"	22" x 22"	15	490
46	New Type SCW	55"	16" x 23"	16	475
	Previous Type	40½"	23" x 23"	18½	500
69	New Type SCW	61"	16" x 23"	18	525
	Previous Type	46½"	28½" x 28½"	35	1000

ALLIS-CHALMERS

25% More CLAMPING FORCE!

Amazing CFC* Process Sets Impressive New Standards for Connector Performance

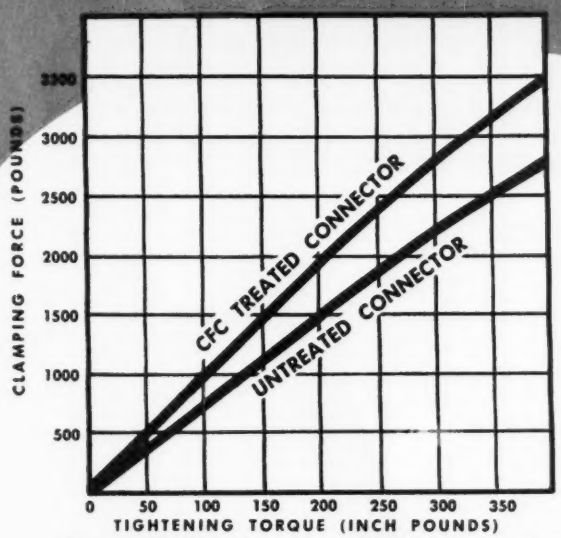


Fig. 1: *Clamping force vs. tightening torque for No. 2 stranded connectors, comparing CFC treated connectors with untreated connectors of the same lot.*

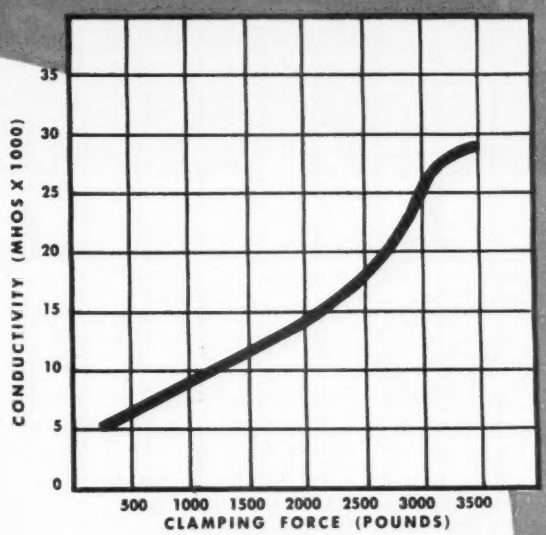
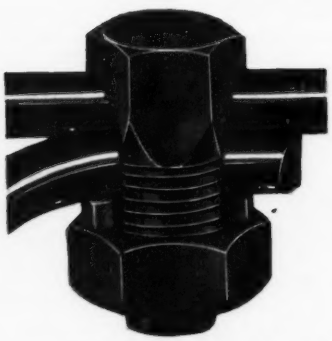


Fig. 2: *Conductivity vs. clamping force for No. 2 stranded hard drawn conductors.*



BLACKBURN'S exclusive chemical process for copper alloy connectors drastically reduces thread friction — increases clamping force — produces lower-resistance connections — and insures lasting, trouble-free service.

The above graphs show the great advantages of CFC treated Connectors. Note over 25% increase in clamping force. Note also how clamping force greatly increases conductivity of the connection. Thus, high clamping force, plus connector strength to **maintain** this force, gives you the **ideal** connection.

BLACKBURN Hi-Strength Connectors give you this **extra** clamping force — give you the **extra** strength to **hold** a maximum-pressure connection . . . Result — absolutely dependable connections that stay tight and trouble-free year after year.

BLACKBURN *Hi-Strength* **CONNECTORS**

*Chemical Friction Control Process—Patent pending

JASPER BLACKBURN CORP.
35 MADISON ST., ST. LOUIS 4, MO.
Phone CEntral 2007

NEW

No. 53-XPJ Nicopress Tool with *Three Grooves*

Write for descriptive folder.

Accommodates Nicopress Sleeves

FOR COPPER

1 solid, 1 seven strand, 2 solid, 2 seven strand, 2 three strand, 3 solid, 4 solid, 4 seven strand, 4 three strand, 6 solid, 6 seven strand, 8 solid, 8 seven strand, 3 No. 10, 3 No. 8.

FOR COPPERWELD

4A, 6A, 8A, 6C, 8C, 6D, 8D, 9½D, 3 No. 10, 3 No. 12, 4 solid, 6 solid, 8 solid, 10 solid.

FOR ALL-ALUMINUM

2 solid, 2 seven strand, 4 solid, 4 seven strand, 6 solid, 6 seven strand, 8 solid.

FOR AMERDUCTOR

8SCP or SCG, 10SCP or SCG, 12SCP or SCG.

Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and foreign countries.

The National Telephone Supply Company

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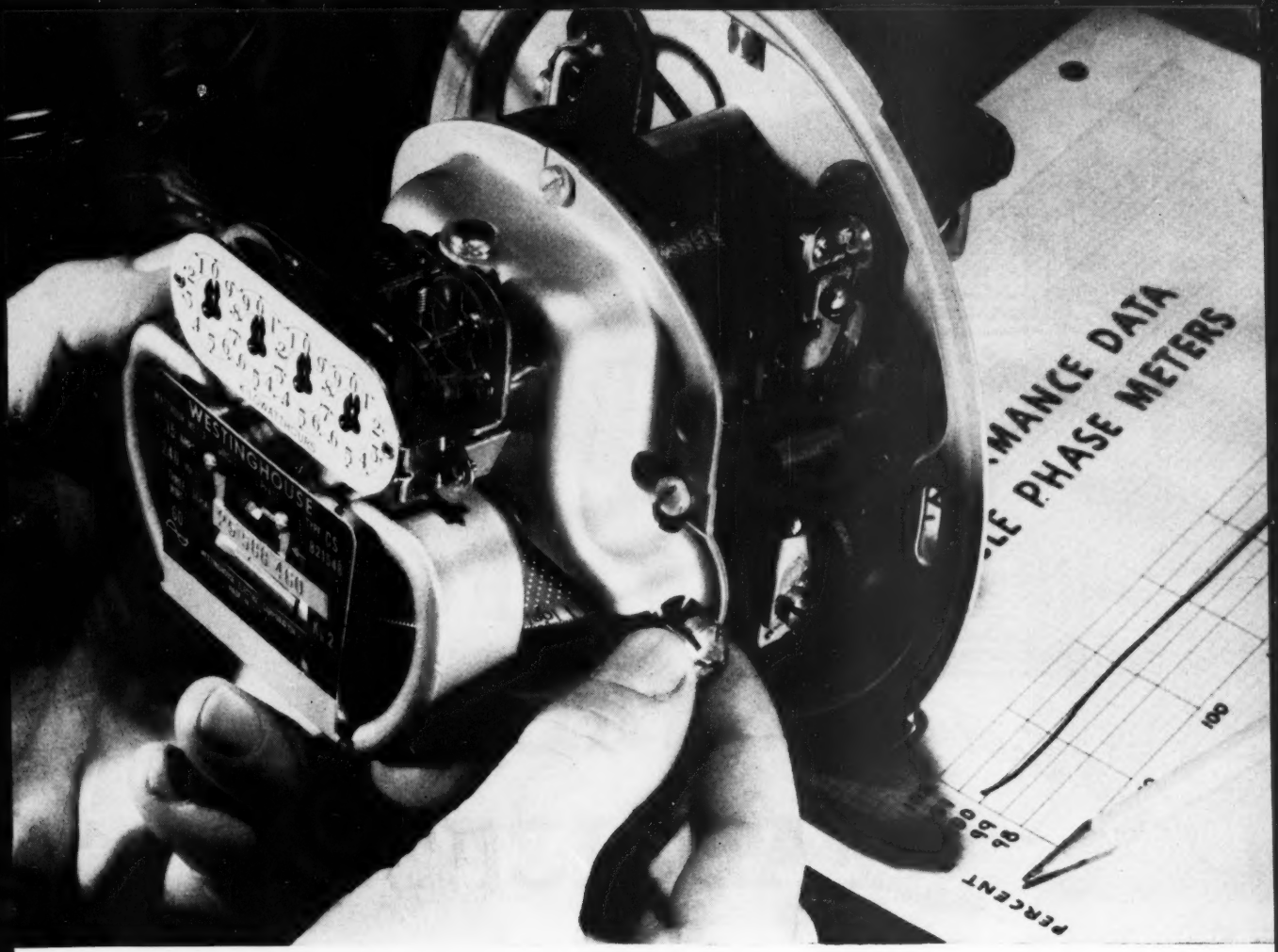
Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY



NEW WESTINGHOUSE ADJUSTMENT DESIGN

makes for quicker, easier calibration

A new light-load adjuster and full-load adjuster in Westinghouse single-phase watthour meters make adjustments quicker and easier. Here's why . . .

An improved light-load adjuster

A knob is now cast on the end of the light-load adjuster which permits you to make adjustment by hand or with screw driver. For convenience, adjustment can be made from either the front or the side. This is very convenient when meters are mounted close together as in gang testing.

A superior full-load adjuster

Here, the introduction of a tiny nylon plug takes all the work out of full-load adjustment and still locks the adjuster screw firmly in place. This is a real timesaver. The nylon is springy, compressible and durable and it exerts constant pressure to hold the adjuster shaft firmly. Yet you can also turn the adjustment wheel against the pressure to adjust the full load directly.

Get more facts on Westinghouse meters

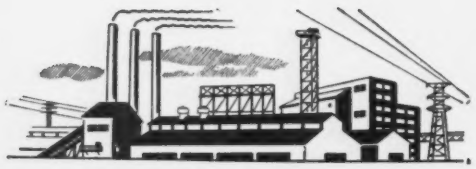
Easier calibration is one of many important features in Westinghouse meters. Get more facts. Write for "What it takes for long-time, low-cost metering", B-4665, a highly informative booklet that discusses the theory and practice of sound metering. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-40444

Everything you need
in meters and instruments

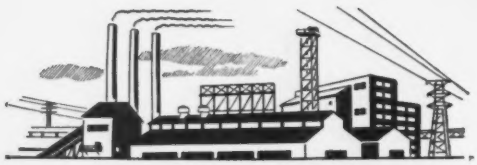
YOU CAN BE **SURE**...IF IT'S

Westinghouse

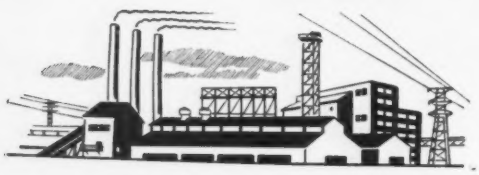


Seattle

3 SHOPS FOR TOWER FABRICATION



South San Francisco



Leetsdale

To meet your transmission-tower requirements, Bethlehem offers the services of three large tower-fabricating shops, at Seattle, Wash., South San Francisco, Calif., and Leetsdale, Pa. Each shop has complete fabricating facilities, and can handle quantity production of any type of tower you may have in mind.

What's more, our engineering staff has had years of experience in designing both single- and double-circuit towers for practically every load condition.

Perhaps you would like to talk over your tower requirements with a Bethlehem man. Just drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL

Bethlehem Steel Company, Bethlehem, Pa.

On the Pacific Coast the fabrication of transmission towers is handled by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Transmission Towers

Because you demand your switches **RUGGED**..

Above, type HPS, 3000 Ampere switch in open position—showing how outer pair of blades have progressed slightly beyond inner pair during sequence operation.

1 CONTACT—Hi-Pressure spot-cleans as it wipes as it closes. High conductivity to withstand short circuit stresses.

2 HINGE—Hi-Pressure, annular line contact—seals against dirt, always constant in any blade position. Uniform pressure washer maintains contact pressure with less critical adjustment than ordinary cup spring washer.

3 BLADE LATCH—Positive protection against short circuits. Combined lock and pryout operated with eye hook.

4 PRESSURE CLIPS—Phosphor Bronze individual spring clip for each Spot Contact on blade.

5 BLADE OPERATION—Sequence movement. Blades released from contact pressure in pairs to reduce operating effort.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

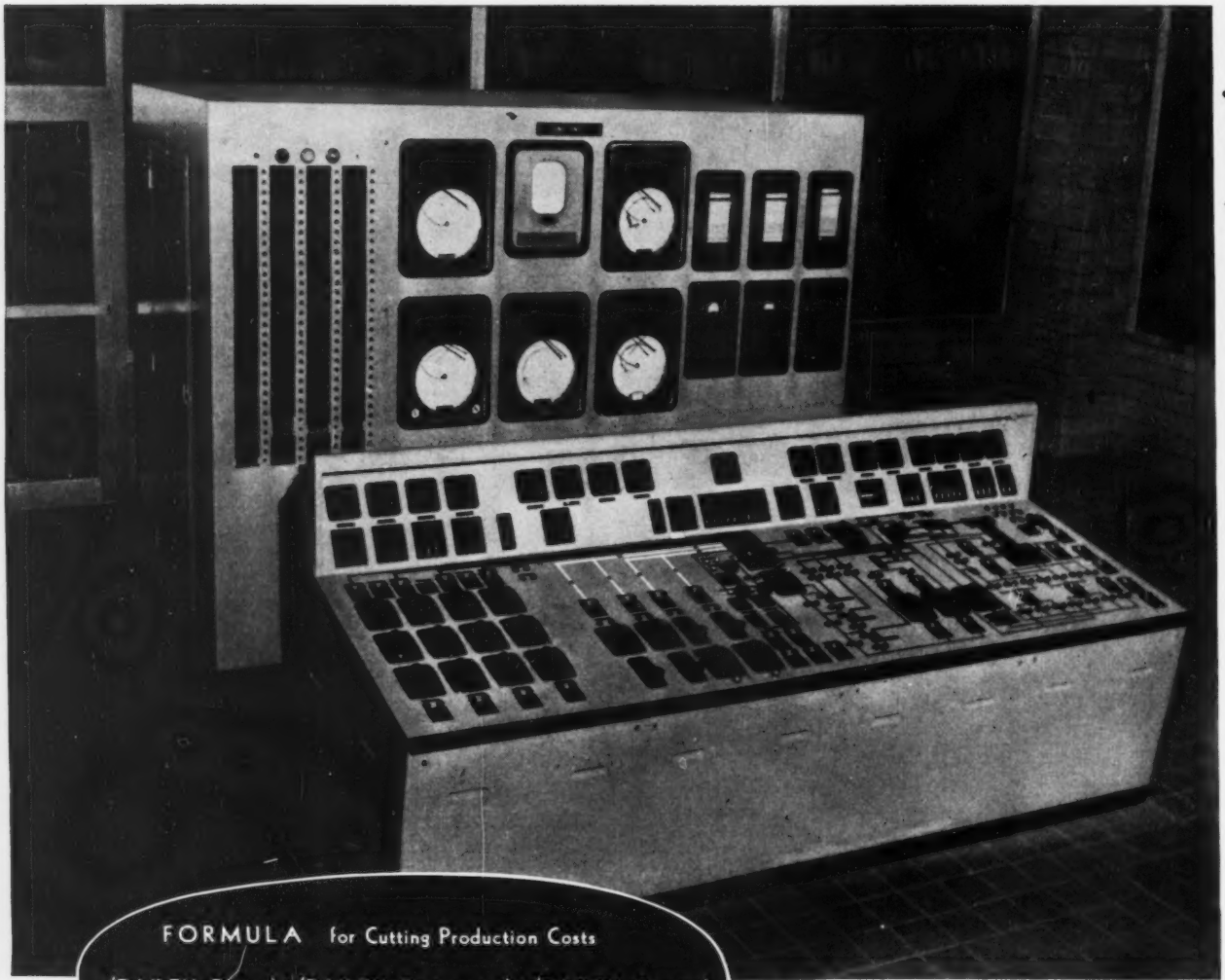
TESTING DEVICES

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

How to Increase the Return on



FORMULA for Cutting Production Costs

(BAILEY Design) + (BAILEY Engineering) + (BAILEY Service)

= GREATER SAVINGS PER FUEL DOLLAR

Control Center for 60,000 kw reheat boiler-turbine Unit No. 1 at Danskammer Point Steam Station of Central Hudson Gas & Electric Corp. Bailey MINI-LINE Equipment on benchboard gives operators fingertip control while larger recorders on vertical board show operating trends and make permanent records. Duplicate Bailey Equipment has been purchased for Unit No. 2.

Engineering and construction by Burns and Roe, Inc.

Your Boiler Room Investment

★ There are four important ways to increase the return on your Boiler Room Investment:

More power per fuel dollar
Less outage
Delivery of steam at design conditions
Greater operating safety

None of these items taken alone will produce the highest return—it takes all four working in close harmony.

That's where co-ordinated controls by Bailey Meter Company help. And here is why Bailey Controls are your best choice:

1. Complete Range of Equipment—fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you. Bailey Meter Company's Sales-Service Engineers are located in more Industrial Centers than those of any other manufacturer of Boiler Control Systems; you get prompt, experienced service with a minimum of travel-time and expense.

For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage, steam at design conditions, and greater operating safety—you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More Power To You!"

A-115-2

BAILEY METER COMPANY
1060 IVANHOE ROAD
CLEVELAND 10, OHIO
Complete Controls for Steam Plants

BAILEY METERS
Controls for
COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

ONLY $270 BUYS A PACKAGE OF FULLY AUTOMATIC FIRE PROTECTION

Anyone who can measure volume . . . and can cut pipe . . . can install this ready-made fully automatic fire extinguishing system that requires no power source.

It includes Kidde's split-second rate-of-temperature-rise heat detector (the fastest detection known to the fire-fighting industry), Kidde's powerful Multijet nozzle and a 50-pound cylinder of fire-killing carbon dioxide. You even get a monometer tester. Pipe and fittings are optional.

Six Kidde Standard Paks are available for volumes from 800 up to 6,000 cubic feet.

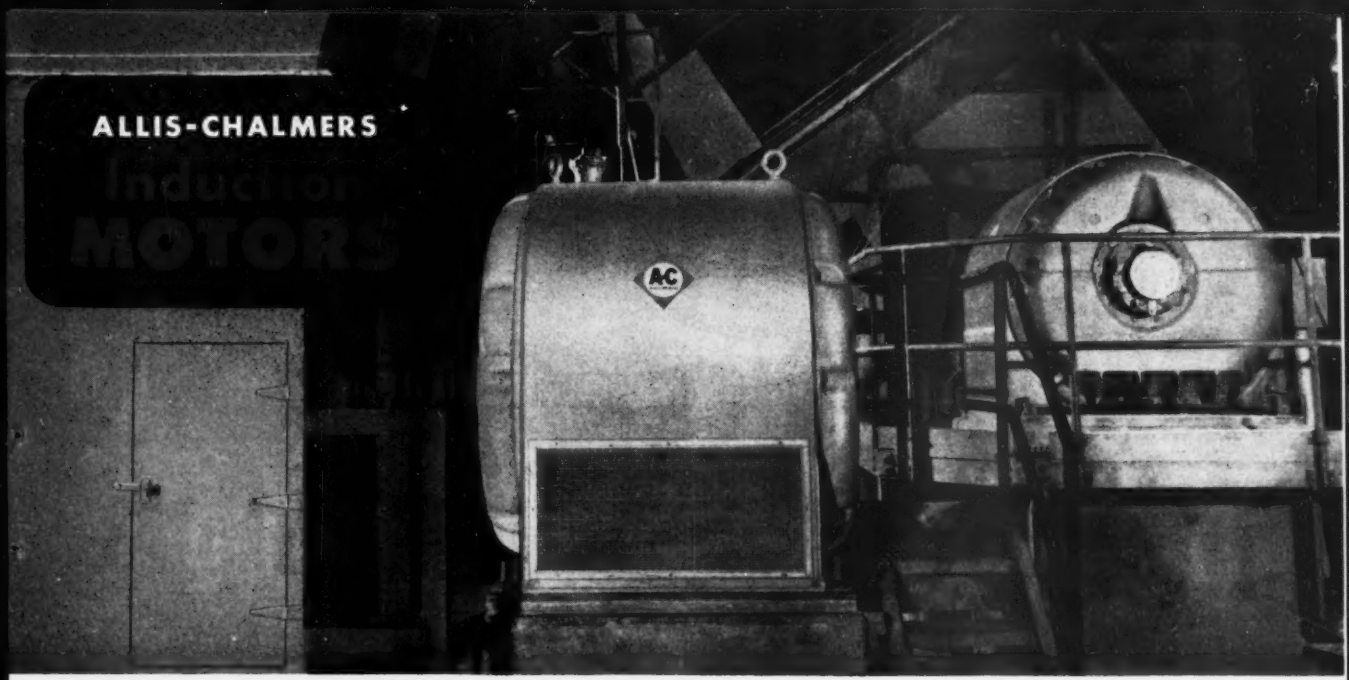
All components of Kidde Standard Paks are the same as those used in Kidde custom-designed installations. The difference is that Kidde has pre-engineered the Paks for small hazards. And the savings on volume distribution are passed on to you!

You just can't beat Kidde Standard Paks for inexpensive night-and-day protection against normal flammable liquid hazards.

Remember, fire won't wait till you're ready. Better write today for full information.

Kidde

Walter Kidde & Company, Inc.
730 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.



Left to right (above) are drip-proof, silicone insulated, 1000-hp, forced and induced-draft fan motors for unit No. 2. Forced draft fan motors for unit No. 3 will be of the weather-protected type for installation outdoors.

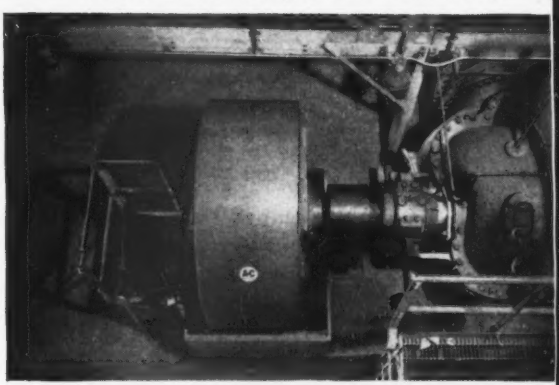
LET'S TAKE A LOOK AT TANNERS CREEK

One thing you're sure to notice at the Tanners Creek plant is that all the major auxiliaries for generating unit No. 2 are driven by Allis-Chalmers motors. Pictured here are a few of the larger ratings in this modern power plant of Indiana & Michigan Electric Company, a part of the American Gas and Electric system.

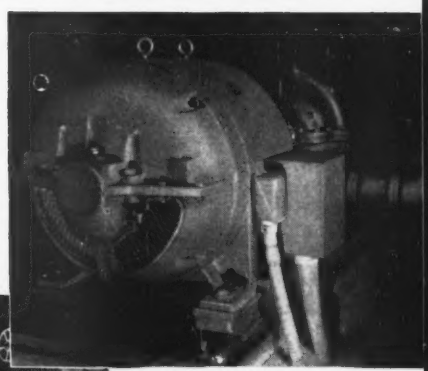
It's worthy of note that A-C is also building the motors for generating unit No. 3, scheduled for operation in 1954.

Allis-Chalmers builds a complete line of integral horsepower motors for power plant service, and your A-C representative can help you select the motors you need.

A-4084



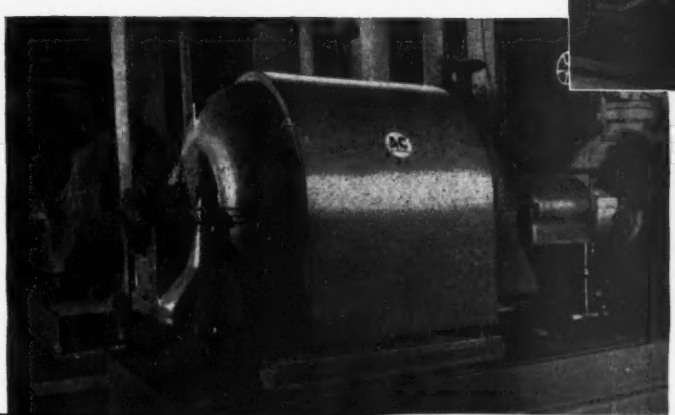
One of two 300-hp, 2300-volt, 218-rpm, drip-proof squirrel-cage motors driving circulating water pumps.



Rated 200 hp, 2300 volts, 1760 rpm, this drip-proof squirrel-cage motor driving an Allis-Chalmers screen wash pump is typical of the smaller ratings.

ALLIS-CHALMERS

Milwaukee 1, Wisconsin



These dependable boiler-feed pump motors are rated 2000 hp, 2300 volts, 3580 rpm each.

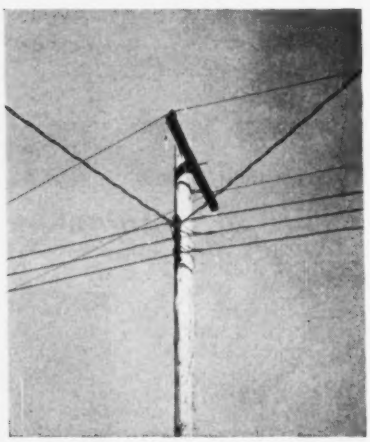
Rome Aluminum Triplex

Triplex Self-Supporting Secondary and Service Drop Cable—Regularly supplied with stranded or solid all-aluminum power conductors, insulated with RoPrene (Neoprene) and incorporating ACSR or other suitable bare neutral messenger. All-aluminum, copper or copperweld messengers are also available. RoLene (polyethylene) insulation can be supplied in place of RoPrene.

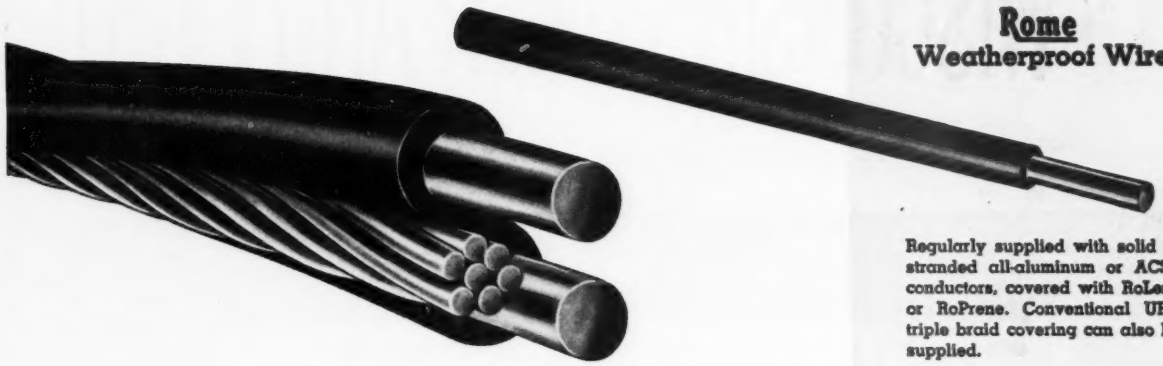
Rome Triplex Service Drop Cable provides neat, clean looking installation in new homes area.

Triplex is ideal for replacements on older houses too, particularly where eaves and roofs pose space problem.

Rome Triplex is less subject to damage by storm and falling tree limbs ... will remain in operation SAFELY even when down.



Installation at pole and house is easy and quick, cutting costly manhours and permitting less expensive hardware.



Rome
Weatherproof Wire

Regularly supplied with solid or stranded all-aluminum or ACSR conductors, covered with RoLene or RoPrene. Conventional URC triple braid covering can also be supplied.

OFFERS YOU A HOST OF COST ADVANTAGES

Many applications of Rome Aluminum Triplex secondary and service drop cable show outstanding cost advantages over conventional bare or weatherproof open wire construction.

For one thing, by proper mechanical design it may eliminate one-third to one-half the number of poles normally required. This adds up to a substantial saving. Further, it is also possible to utilize mid-span connections for service drops.

Rome Aluminum Triplex is particularly desirable for new residential developments. It is neat in appearance while mechanical design and light weight minimize sag tendencies. This cable construction, with its strong messenger, also affords greater protection against wind and ice loading damage.

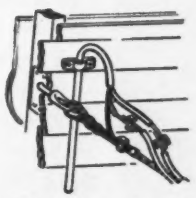
Fewer accessories are needed for secondary and service drop connections than for open wire construction. Maintenance is less costly; conductors are easily accessible.

Longer service life is assured because of mechanical design. RoPrene (Neoprene) and RoLene (polyethylene) insulation have exceptional resistance to weather and all climatic conditions. There are no braids to rot or festoon. Replacement is minimized.

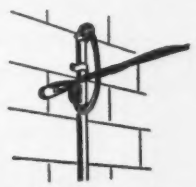
So whether it's secondary or service drop cable or weatherproof wire for distribution, Rome Aluminum offers you a host of advantages. May we send you samples?

Typical Connections

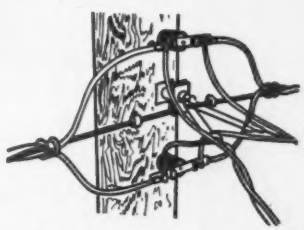
Service connection



Built-in attachment for dead-ending.



Dead end (house)



Service tap (from secondary cable)

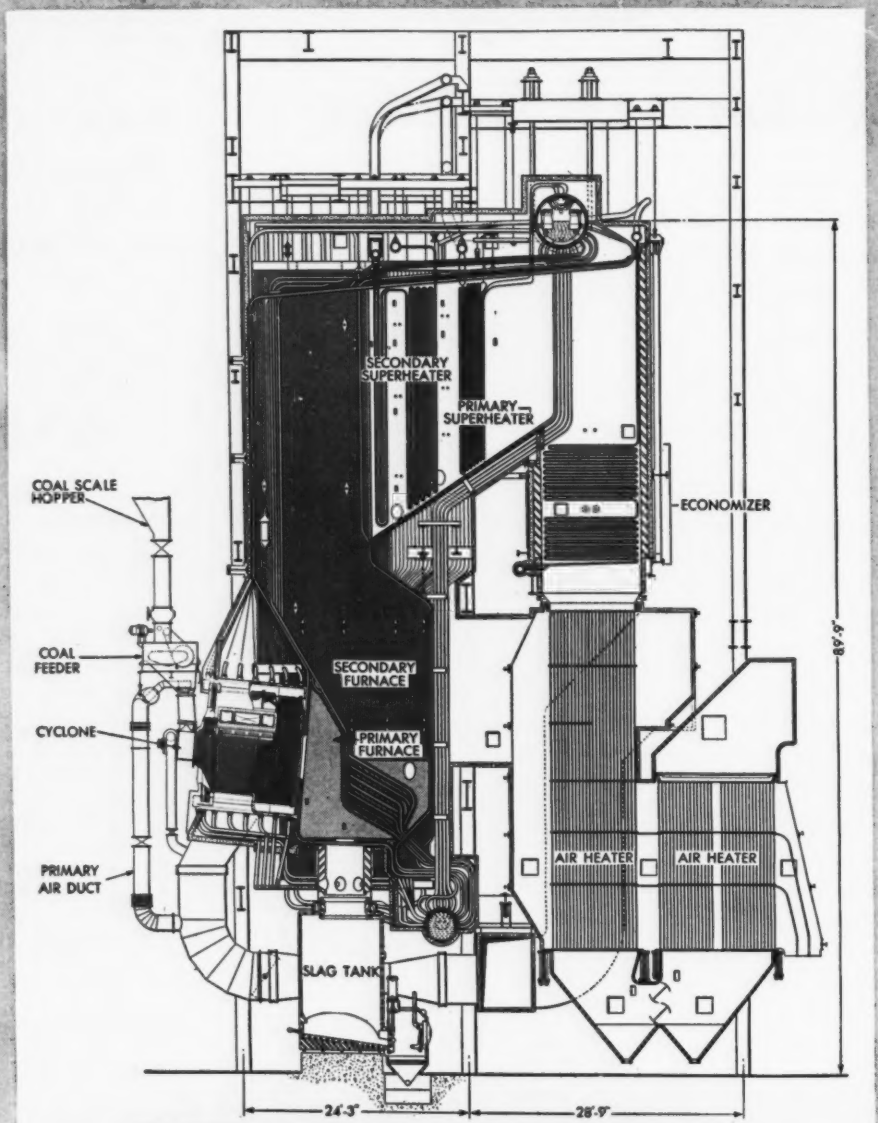
Rome ALUMINUM

It Costs Less to Buy the Best

ROME CABLE CORPORATION, ROME, N.Y., AND TORRANCE, CALIF.

WISCONSIN POWER AND LIGHT

on the line

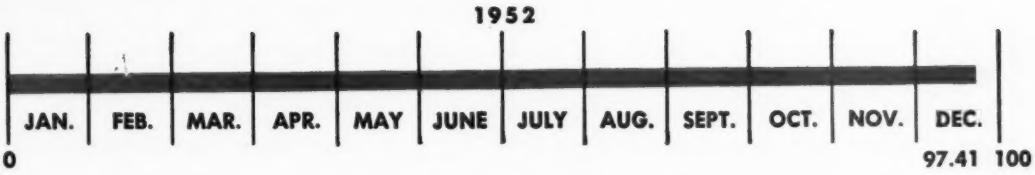


B&W CYCLONE-FIRED RADIANT BOILER

This unit has a steam generating capacity of 600,000 pounds per hour, with superheater outlet conditions of 1325 psi and 960F. It has a design pressure of 1525 psi and employs natural circulation. The boiler is equipped with a superheater, an economizer, and a vertical tubular air heater.

COMPANY'S CYCLONE-FIRED BOILER

97.41% of the year



at EDGEWATER PLANT

This outstanding record for a coal-burning unit was established during 1952 by the operators of Wisconsin Power and Light's Cyclone-Fired B&W Radiant boiler at the Edgewater Plant.

Cyclone Furnaces make a major contribution to high availability because they eliminate so much of the coal preparing equipment that is a source of continuous maintenance and possible outage. Cyclones burn coal that is merely crushed, not pulverized. This means that banks of many pulverizers, with their moving parts, motors, fans, lubricating systems, burners, piping and ducts, are eliminated. They are replaced by a few sturdy, simple Cyclone Furnaces.

Ease of operation and increased safety with the Cyclone Furnace are also important factors that mean sustained on-the-line performance. There are far fewer burners to light with Cyclone Furnaces, and because they use crushed coal, they eliminate the danger of furnace explosions that might occur with powdered fuel.

Further, by keeping the ash where it belongs—in the furnace—and severely reducing the amount of fly ash in the combustion gas, the Cyclone Furnace further contributes to high levels of operation. Ash accumulations on boiler and other surfaces are curtailed, and wear on boiler parts, and on machinery such as induced-draft fans, is greatly reduced.

Increased availability is just one of the many advantages to be obtained from Cyclone Furnace Firing. Other important benefits include reduced atmospheric pollution and a money-saving solution to the fly-ash problem, reduced cost of maintenance, greater efficiency, and boiler-room space savings.

Twenty B&W Cyclone-Fired Boilers are now in operation and have a total accumulated service time of over 50 years. Many other Cyclone-fired boilers are under construction.

We will be pleased to discuss with you the many positive advantages which Cyclone Furnace Firing can contribute to your operations. The Babcock & Wilcox Co., Boiler Division, 161 East 42nd Street, New York 17, N. Y.

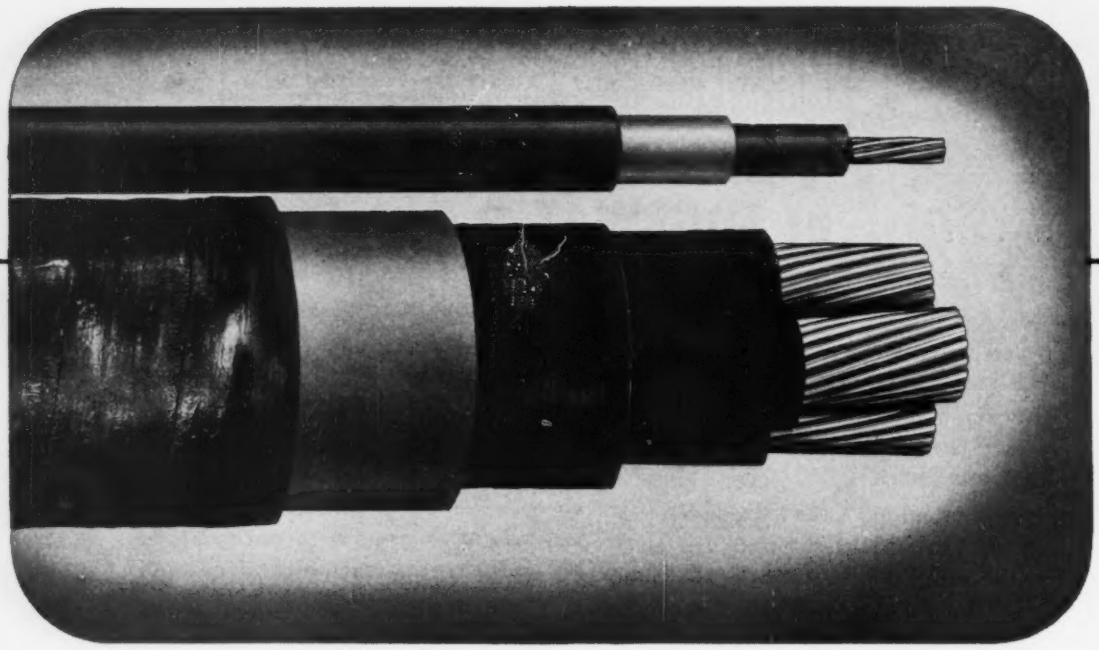
BABCOCK & WILCOX

BOILER DIVISION

G-607

ROEBLING PROTECTIVE COVERINGS ON LEAD SHEATHED CABLE

for utilities, chemical plants and the petroleum industry



LEAD SHEATHED CABLES used in certain applications by public and private utilities, chemical plants and the petroleum industry are often impaired by electrolysis or chemical corrosion. But such corrosive action can be effectively reduced, and cable life extended, by using Roebling Paper Insulated and Varnished Cambric Cables with either of two outer protective coverings.

One of these coverings is an extruded thermoplastic sheath employing a special high-molecular weight polyethylene. The other is ROESHEATH, built up of neoprene and neoprene-filled fabric tapes and vulcanized directly over the lead sheath. Both coverings not only provide essential protection, but, in some cases, may permit the thickness of the lead sheath to be reduced.

For longer, more dependable cable life and worthwhile economy write for full information... and get our recommendations for solving any special problem.

John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

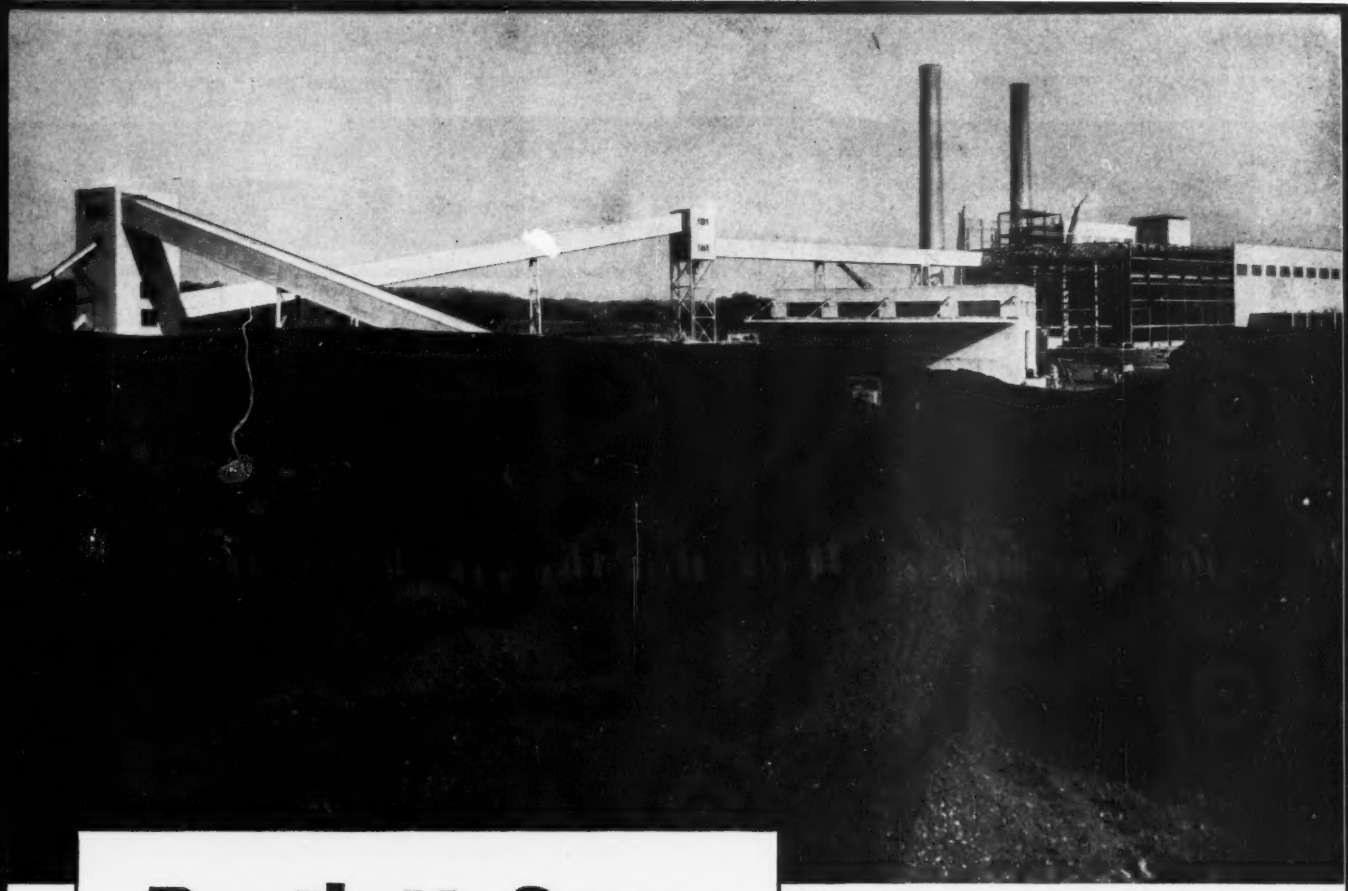
A subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST & 130 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1930 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, 1301 CLARK BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

CF&I

JR ROEBLING



General View of O. H. Hutchings Station
Dayton Power and Light Company
Ebasco Services Incorporated
Consulting Engineers

Bartlett-Snow coal handling at Dayton

● The view above shows the first 120,000 KW unit of a plant which will be extended into a 360,000 KW station. The track and reclaiming hoppers, apron feeders, the three 700 ton per hour belt conveyors that total 1,178 feet in length, gates, chutes, and transfer points were detailed and fabricated in our shops and installed by our erectors to Ebasco Services Incorporated's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers work with you on your next job.

Gates and Apron Feeders Under
Track and Reclaiming Hoppers

Drive For 700 Ton Per Hour
Belt Conveyor

DESIGNERS ENGINEERS FABRICATORS ERECTORS

BARTLETT-SNOW
CLEVELAND 5, OHIO

"Builders of Equipment for People You Know"

NEW

ALLIS-CHALMERS

OIL CIRCUIT BREAKERS

Here's the inside story of recent improvements in this time-proved breaker. This breaker has long been used for outdoor distribution service where safe, reliable operation is a necessity. Now it is even more easily installed and maintained. This means a further reduction in your circuit breaker service costs because of the following features. A-4074

1. New "full view" doors open to expose three sides of operator cabinet—not just one.
2. Gasketed doors make cabinet completely weatherproof.
3. Cabinet is enlarged to house accelerating adjustment mechanism, solenoid operator and connecting linkage. Accelerating spring is easily accessible.
4. Simplified operator and pole unit mechanisms. Fewer parts now used for simplicity — added reliability.
5. Maintenance closing handle can be used from either front or side of control cabinet. This means breaker may be used in confined area.
6. Shielded vitreous enameled space heater provided.
7. Manual trip now located higher on back of cabinet to help prevent accidental tripping.
8. Simplified transformer wiring duct. Removal of single bottom plate of wiring duct exposes continuous transformer leads along full length of duct.
9. Self-aligning tulip and bayonet contacts retained.
10. Contacts are at convenient level — no interference from the frame.
11. Thoroughly proved *Ruptor* arc-interrupting device retained.
12. Easy tank removal! There is no interference from frame.
13. Individual rectangular tanks occupy less space, using less oil and providing best electrical clearances.
14. Tank lifter mounted on back — operated from either side.
15. Grounding pad is stainless steel faced.

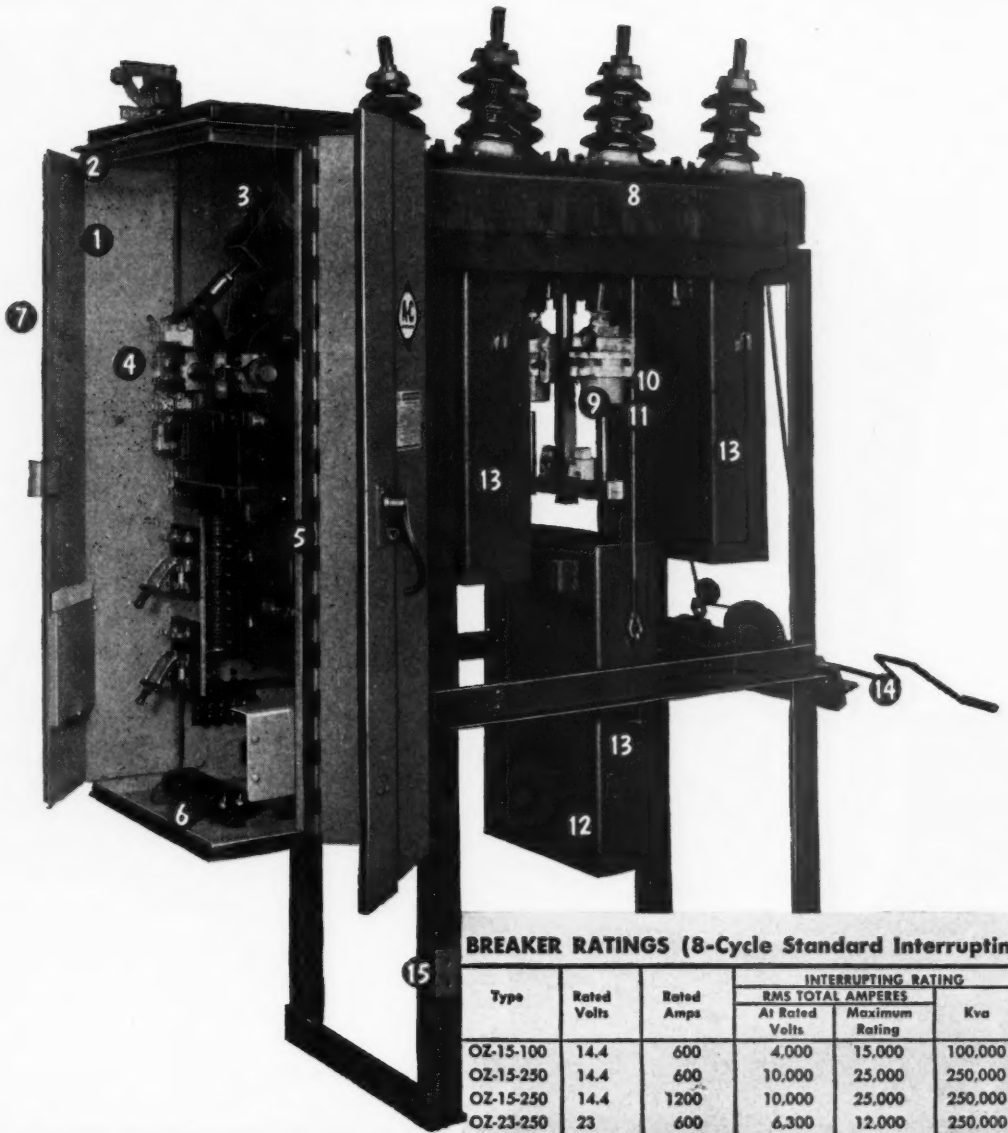
Standard outdoor automatic reclosing relay equipment and cabinet are available.

Ruptor is an Allis-Chalmers trademark.

ALLIS-

Accessibility

For Inspection...Test...Maintenance



BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Volts	Rated Amps	INTERRUPTING RATING RMS TOTAL AMPERES			Weight of Breaker With Oil (lbs)
			At Rated Volts	Maximum Rating	Kva	
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

CHALMERS

A-C ALLIS-CHALMERS

KERITE
CABLE-GRAM
THERE'S AN IMPORTANT DOLLAR DIFFERENCE BETWEEN SERVICE AND MAINTENANCE: THE MORE SERVICE THE SELLER PUTS INTO HIS PRODUCT THROUGH QUALITY MANUFACTURE, THE LESS MAINTENANCE TIME AND EXPENSE THE BUYER HAS TO WORRY ABOUT.
THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.

DAY KERITE

KERITE CABLE

THE KERITE COMPANY
30 Church St., N. Y. 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago;
582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.;
31 St. James Ave., Boston

EDITORIALS

Foreign Competition for Power Equipment

The problem of foreign competition in the electric power equipment field continues to be a major headache for American manufacturers. Important foreign competitors include Ferranti Electric, Ltd, Brown Boveri Corp, English Electric Co, Ltd, and Pacific Oerlikon Co. From the Far East, Nippon Gaisha Kaisha, Ltd, of Japan has entered the competition for supplying suspension insulators for Bonneville.

Foreign concerns have been able to underbid American companies by substantial amounts. The principal reason being attributed to the fact that labor rates are one-fourth those existing in the United States.

To help protect our manufacturers, there is a duty on the foreign-made equipment. In addition, a further differential up to as much as 25% of the base price of the foreign equipment is sometimes added in comparing bids by governmental agencies.

On the other hand, the bids of American manufacturers are usually treated on a basis of maximum cost. Maximum escalation is used for comparative purposes and no credit is given for taxes paid in the U. S.

Many arguments have been presented by both groups to support their requests for the awarding of contracts. The foreign competition uses the "trade not aid" slogan very effectively and has had considerable support from the Department of State. The American manufacturers argue that we need to protect our industry as a defense measure, consider the replacement and maintenance of equipment in case of war, protect American standard of living as reflected in labor rates, and give consideration to taxes paid. They also rely to some extent upon the "Buy American" act.

Obviously the problem of treating both foreign and domestic manufacturers fairly is a difficult one. But it is particularly important that the matter be clearly understood by those who profess to have an opinion.

We have in our hands one illustration of the major differences in the position of the manufacturers. It would be impossible to present data that is 100% accurate but the following will illustrate the problem.

In connection with the main transformers for Chief Joseph Dam, the maximum costs under the bids as evaluated by the Army were about $2,304,000 for English Electric and about $2,640,000 for Moloney Electric Co. On the basis of 336,000 man-hours of direct labor, the labor cost in the English Electric bid would be about $188,000 and $699,000 for Moloney Electric. The total taxes paid by Moloney, its employees and suppliers are estimated at $660,000 compared with the duty paid by English Electric of around $140,000. If an adjustment were made for either one of these items, the picture would change materially. A differential allowed under the "Buy American" act was not applied by the Army in this case.

Such a marked difference between the delivered costs of competitors in the electrical equipment market presents a serious situation. We believe that all factors should be carefully considered when contracts are awarded for electrical equipment.

Illinois Becomes a "Fair Value" State

Two cases have now decided that the State of Illinois recognizes "fair value" for rate-making purposes.

In the first case, early this year, the electric industry can thank the Illinois Bell Co and the Bell System for their courageous and successful stand before the Illinois State Supreme Court on a case which Illinois Bell appealed from a lower court decision. The Supreme Court established real "fair value" as the yardstick in determining the rate base.

Until then, in spite of statutes to the contrary, it could be said that Illinois ranked with the Federal Power Commission as one of the strongholds of the "original cost" doctrine. The so-called "fair value" was just another name for "original cost."

In the second case, the ruling by the Supreme Court set a precedent when Peoples Gas Light & Coke Co asked for a rate increase before the Illinois Commerce Commission. The ICC considered both "original cost" and "reproduction cost new" in establishing a rate base for the Peoples company.

After considering the facts, the commission issued its order which fully implemented the court's findings by arriving at a "fair value" rate base some 29% greater than net "original cost" rate base of the property. The electric industry may well compare this forthright action with that of another state where apparently the legal and moral requirements, and certainly the political ones, are satisfied by increasing "net original cost" by 3% and then blandly calling this "fair value."

An important inference which utilities can draw from this decision is that the mere cessation or temporary slowing down of the upward march of the costs of construction does not remove what Chairman Benjamin Feinberg of the New York Public Service Commission, once called the "imbedded inflation" of past years. Years in which the industry undertook the largest expansion of its history.

Even if prices stay stable from now on additional income will be needed to take care of inflation that has already taken place and for which, in many instances, utilities had not received proper compensation. To do otherwise would be to deprive the equity investors of their just earnings.

Let's hope that other regulatory bodies now using the "original cost" theory will consider the "fair value" concept in establishing a rate base for the electric companies.

The Modern Managers Need More Skills

In modern enterprise the more successful a man is in the application of his technical specialty, the less he is apt to use it, according to Ralph M. Besse, Executive Vice President of Cleveland Electric Illuminating Co in a recent speech at the Summer Meeting of the American Institute of Electrical Engineers. Of course it is presumed that such a technical man advances up the management ladder. And then said Besse, the requirement for broad management skills becomes increasingly greater as the use of a technical skill becomes increasingly smaller.

He pointed out that the complexity of modern enterprise calls for many different skills; the skills of living under and dealing with a government, of negotiating with labor unions, of predicting money markets, of assuring world sources of materials, of minimizing taxation, and of analyzing sales media. In addition, some further skills are required to implement new broad philosophies of service and citizenship as adopted by modern corporations.

Summarizing the skills of management applicable to all enterprise, Besse gave these four points:

1. The ability to so direct the enterprise that it will render increasing service to its customers.
2. The ability to make the enterprise profitable.
3. The ability to obtain the full participation of employees in the enterprise, and
4. The ability to make people adaptable to change.

All those aspiring to top jobs would profit by a perusal of Besse's discussion of the skills required for modern management.

Trees to Make Everybody Happy

Trees can be an expensive nuisance as most electric utilities believe, or trees can be a beautiful and useful adjunct to the homes an electric utility serves as Pacific Gas & Electric Co believes. Actually PG&E is not in complete disagreement with the other utilities. But the California company believes it has found the way to eliminate troublesome trees, cut its costs for tree trimming, and still make everybody happy.

The solution is a Comprehensive Community Street Tree Plan. All the details may be found in a 16-page, four-color booklet, "Trees to Fit Your Home and Your Street." The booklet is the company's first step in selling the public on planting trees that don't grow too high or too wide and that do not have any "bad" habits.

PG&E believes that it can sell this plan to the public which has as much to gain as the company, then to the garden clubs and similar groups, and then to civic officials. After everybody is sold, the company hopes government units will then more or less make the plan official by adopting ordinances governing the planting of trees. This is a wonderful idea. We hope it proves successful and is copied in other areas of the country.

Are Advertising Costs too High–

Electric companies occasionally are criticized for the "huge" amounts they spend for advertising. Now from a survey made by the Public Utilities Advertising Association the "huge" amount can be calculated. This report shows that in 1952 the average electric company spent 91¢ per customer or 0.6% of its gross revenues. Combination companies spent only 72¢ and 0.57% respectively. Based on electric customers this means the industry's private companies spent at the most $44 million. Based on per cent of gross revenues they spent around $37 million.

Let us assume the higher figure is the true one. The report indicated that roughly 13% of this sum went for salaries. Then only $38,280,000 remained for all other advertising expenses. Is this too much for one industry to spend in one year to influence Americans to live easier and more comfortable lives, to increase their productivity, to prolong their lives, to protect their health, to fight for the free enterprise system which has made all these blessings possible? We say, and every fair-minded American will join in the chorus, "No! It is not half enough."

THE ELECTRICAL WEEK

The Issue's News Highlights—Idaho Power Co offers to construct its three-dam development plan for the Snake River within 34 months at hearings before FPC on the company's program.

Governor Dewey of New York makes an attempt to head off House approval of a bill permitting five utilities to develop additional power at Niagara Falls. Senate action on the bill is unlikely at this session.

Interior signs interim contracts with Georgia Power, Appalachian Electric for sale of federal power.

West Virginia State Supreme Court refuses to review a PSC order of Jan. 30, 1953, which rejected Appalachian Electric Power's plea for a 9.75% rate increase.

Alabama Power's seven-year experiments in underground gasification of coal ended on June 20 when company put out underground fires by pumping water into outlet holes in its Gorgas mine. Reason: Federal Bureau of Mines was unable to gain Congressional approval for additional appropriation to help finance the project.

Off the New England Wire—Massachusetts State Auditor T. J. Buckley urges a study to determine whether the 25-cycle generating plants of Metropolitan Transit Authority should be disposed of in favor of buying power from Boston Edison as one means of reducing the MTA deficit now borne by the area taxpayers served by the railway. A 40,000-kw frequency changer is now installed between the two systems.

House Rules Committee has cleared for floor debate the bill which would permit the five New York electric companies to develop additional generating facilities at Niagara Falls (see p 110).

Ohio Edison and UWUA-CIO agree to wage increases which will average 10¢ an hour, retroactive to July 1 . . . California Electric Power and IBEW-AFL sign pact increasing wages by 5% or $15 a month, retroactive to Dec. 1, 1952, with slight shift differentials for operating employees working on afternoon and night shifts. This settles a labor dispute which had caused a strike running from March 10 to April 2, 1953.

Idaho State Sen Clark Hamilton demands resignation of entire Idaho PUC on the grounds that the PUC has surrendered its jurisdiction to the courts. He accuses PUC of knowing all along that the courts were going to overrule their decision denying a rate increase to Mountain States T&T.

At dedication ceremonies for Portland General Electric's renamed and remodeled T. W. Sullivan hydro plant at Williamette Falls, PGE's Chairman T. W. Delzell voiced a willingness to cooperate in a joint venture with other private utilities, federal government, municipalities, or PUD's if necessary to meet the estimated need of 400,000 more kilowatts each year for next ten years in northern Oregon, Washington, and Idaho.

Off the Washington Wire—House has passed and sent to the Senate a bill which would lift restrictions on AEC's liability in cancelling power contracts for AEC plants in Ohio, Kentucky, and Tennessee. Under the bill, AEC would assume full responsibility for costs arising from cancelling contracts with Ohio Valley Electric Corp, Electric Energy, Inc, or TVA . . . Senate has passed a bill which would permit State of Oklahoma to build the 15,000-kw Markham Ferry project on Grand River. Federal government would contribute $6.5 million for flood control portion of project.

Republican Administration continues to pare payrolls of federal power agencies. "Reduction in force" notices went out last week to some 500 BPA employees, although the net reduction is not expected to be more than 100 employees. Bureau of Reclamation has reduced its force by 1,439 since the first of the year, SPA by 39 and Sepa by about 10 . . . Senate Appropriations subcommittee declined to up TVA power funds beyond the $178 million recommended by the Eisenhower Administration. This appears to rule out any hopes for TVA Fulton steam plant for this fiscal year.

Interior Secretary McKay by phone to "The Oregonian" reports revised contract of BPA and Portland General Electric will be completed shortly and be again submitted to public agencies and BPA industrial consumers before signing. McKay declined to reveal provisions changes in contract redraft, but said some still are being written by Interior Department Solicitor Clarence Davis who met with Administrator Raver in Washington recently . . . Interior Secretary has ordered Bureau of Reclamation to negotiate a water-use agreement which will permit Southern California Edison to build a 126,000-kw hydro project at Mammoth pool site on upper San Joaquin River.

Carolina P&L will build a bundled conductor 115-kv transmission line this fall. This is reported to be the first bundled conductor transmission line installation in the U. S.

Congratulations—Donald C. Cook, former SEC chairman, is appointed a vice president and assistant to the president of American G&E Service . . . Iowa Public Service elevates Vice Pres E. M. Raun to vice president and general manager and East Division Manager Merl Parr to vice president . . . Bathurst (New Brunswick, Can.) Power & Paper elects R. H. Christian executive vice president . . . Former Board Chairman Darwin Curtis is elected president and treasurer of Curtis Lighting to replace the late Melvin C. Wilt . . . Sprague Electric appoints Dr Wilbur A. Lazier vice president and technical director in charge of research and engineering and Neal W. Welch vice president in charge of sales . . . Lewis K. Sillcox, vice chairman of board of New York Air Brake, is nominated president of American Society of Mechanical Engineers for 1954.

Obituary—Davis H. Tuck, 64, consulting engineer and former chief electrical engineer of Holophane, died July 5.

FPC Reopens Hells Canyon Hearing

Idaho Power Co promises speedy construction if it is granted permission to build three dams on the Snake River

Idaho Power Co offered a top-speed construction plan and a tie-in with the Northwest Power Pool as hearings reopened last week on development of the Hells Canyon stretch of the Snake River.

Company Attorney R. P. Parry told a Federal Power Commission examiner in Washington that the company could put up its entire three-dam development in 34 months if deemed advisable. This would require simultaneous construction of the dams, rather than sequence construction as now planned.

The three dam projects the company seeks permission to build are: Oxbow project with an installed capacity of 140,000 kw; Brownlee project with a capacity of 360,000 kw; and Hells Canyon project with a capacity of 272,000 kw. Estimated cost of this development plan is $134,319,600.

Would Be In Public Interest . . . The Idaho Power lawyer also argued that the three-dam development is a true multipurpose project and is superior to other plans which will be put before the commission. He argued that a federal license for the company project is "very much in the public interest."

It has been apparent for a long time that the Idaho Power application for the Snake River development is in direct competition with the high-dam plan formerly proposed by the federal administration. Opponents of the company application base their case almost entirely on what they claim is the economic and engineering superiority of the high dam.

Parry fully recognized this opposition in his opening statement last week and said he would present evidence to refute claims of the opposition.

Fail to Win Delay . . . Company statement came after opponents had sought a 90-day continuance of the hearing only to be turned down by Examiner James Costello. This ruling was immediately appealed to the full commission by C. Girard Davidson, attorney for the National Hells Canyon Association, Inc.

Pending commission action on this ruling, Costello ordered the hearing to proceed and several opening statements were offered. Davidson, a former Assistant Secretary of Interior, pleaded that he was not even prepared to make an opening statement.

Asks More Time . . . NHCA, recently organized in the Northwest and sponsored by farm, labor, and public power groups, is heading opposition to the Idaho Power application. Davidson, its chief attorney, told Examiner Costello that his organization needed at least three months to prepare its case.

Davidson said members of his organization had counted on the Interior Department to present the high dam plan to the commission. When Interior stepped out as a special pleader for the high dam, Davidson said this burden then fell upon individual organizations in the area affected.

Davidson requested the aid of Interior lawyers who had worked on the case, but was told that these were not available to NHCA. Interior, however, has offered any technical assistance the Federal Power Commission may require in considering the application of the Idaho Power Co.

Plant Rising on Connecticut River Bank

Hartford Electric Light Co's new Middletown steam plant is taking form on the bank of the Connecticut River. The plant will have an initial capacity of 66,000 kw and will cost approximately $10 million. Site provides room for possible six units of about 500,000 kw capacity. Exterior walls of the plant will be of fluted aluminum.

Pond in lower center of photo will receive discharged ash. Right of way for outgoing transmission line can be seen at left center. Circular foundation of tower structure for outgoing line from switching station below plant is located at upper end of the pond. Intake construction appears at right of the station on the river bank.

Niagara Bill . . .

. . . for private development of river power nears action by House. Dewey seeks delay

Legislation which would permit private enterprise to develop an additional 1.1 million kw of power at Niagara Falls moved toward a showdown in the House of Representatives last week.

However, opponents of the bill including Gov Thomas E. Dewey of New York were bent on delaying final House action for at least a week. House Rules Committee was all set to report out the private enterprise bill last Tuesday, and House debate was scheduled to begin either Wednesday or Thursday.

Schedule Upset . . . This schedule was upset when the Rules Committee placed two other bills ahead of the Niagara bill and indicated it might have to delay consideration for at least a day or two.

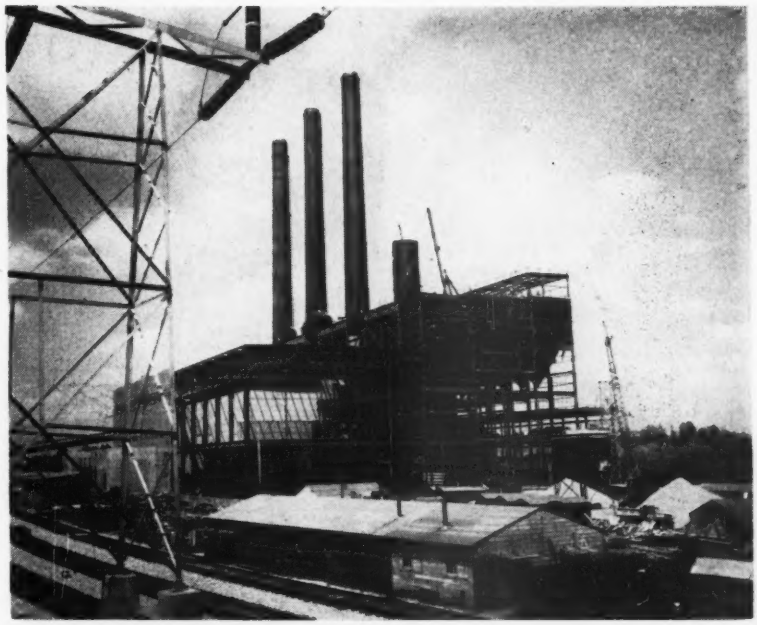
Governor Dewey, who is backing state development of the additional power at Niagara, arrived in Washington shortly after the Rules Committee had put off action. He admitted talking by telephone with House Speaker Joseph Martin earlier in the day, but declined to say whether he had discussed the Niagara legislation. Martin, however, told reporters that the bill had been discussed during the course of conversation.

From all outward appearances Dewey had arrived on the scene too late to completely thwart House action on the private enterprise bill this session. House Republican leadership has already given the bill its blessing and a large number of members are committed to vote for it.

Committee OK Near . . . On the Senate side, the Public Works Committee appeared ready to give its approval whenever it came up for consideration. Committee Chairman Edward Martin, Pennsylvania Republican, introduced the private enterprise bill and will bring it up when he has a committee majority to approve it.

But it appeared that a crowded legislative schedule would block final Senate action on the Niagara bill during the present session. Congressional leaders still are shooting at a July 31 adjournment and Senate leaders have not counted on considering the Niagara bill before adjournment.

Proponents of the bill appear confident that it will gain Congressional approval by next year. Not much consideration has yet been given as to whether it faces a possible veto at the hands of President Eisenhower, although the Administration has several times voiced opposition to it.



Wabash River Plant to Go on Line Shortly

First unit of 100,000-kw capacity is expected to go on line soon at Public Service Co of Indiana's Wabash River Station (above). Second unit is scheduled for operation in December of this year. Units 3 and 4 are scheduled for 1954 and unit 5 for the following year.

Wabash River Station will be tied into the system temporarily through a 132-kv line to the Dresser Station, a few miles downstream. When the two 230-kv wood pole, H frame lines from Wabash River Station to Kokomo and Columbus are completed they will form the station's main tie to the system. Construction of these lines is underway and connection to the system will be through four-winding transformers at Columbus and Kokomo substations which also are nearing completion.

Index Is Available

Electrical World's semi-annual index for January-June 1953 has been prepared and copies are now available upon request. They may be obtained without charge. Address requests to Electrical World, Editorial Office, 330 W. 42nd St., New York 36, N. Y.

Armstrong, Goodwin Named to SEC Posts

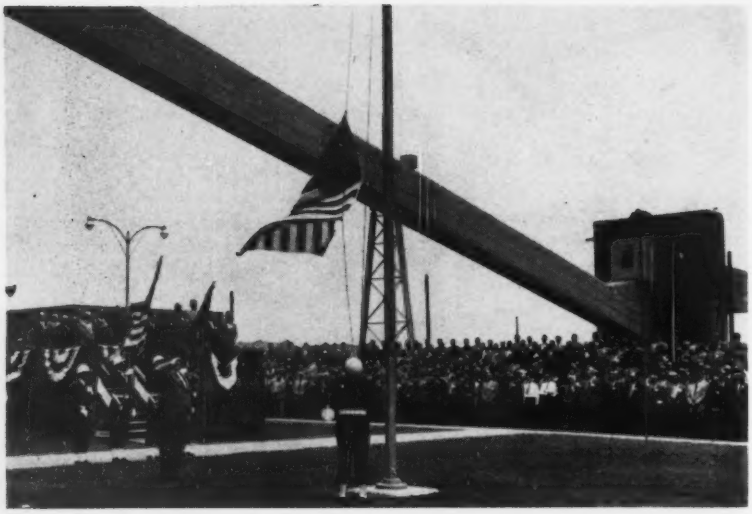
All five positions on the Securities and Exchange Commission will be filled upon Senate confirmation of two recent Presidential appointees.

The new members:

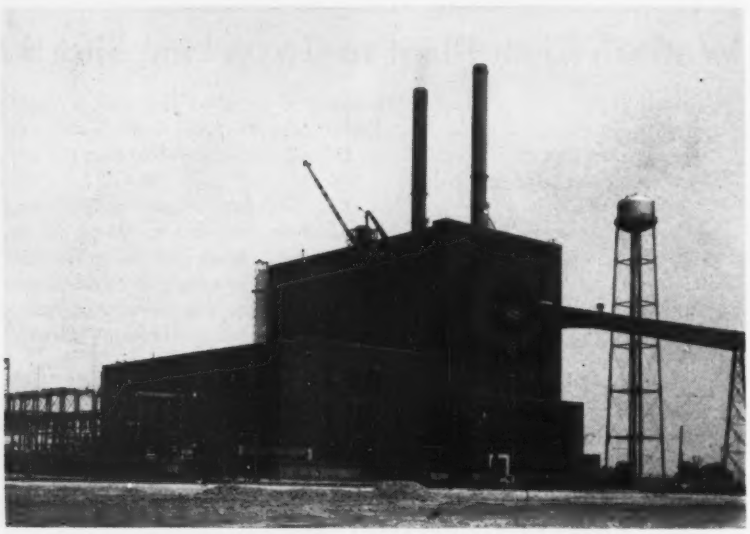
J. Sinclair Armstrong, 37, a Chicago attorney. A Republican, Armstrong is a partner in the firm of Isham, Lincoln & Beale. He is to replace Richard M. McEntire, who recently resigned from SEC.

A. Jack Goodwin, 40, an Anniston, Ala., banker. An Alabama Democrat who campaigned for Eisenhower last year, Goodwin is to fill the unexpired term of former SEC Chairman Donald C. Cook.

Confirmation of Armstrong will give SEC a Republican majority for the first time in the commission's 19-year history.



Flag Raising Ceremony Marks . . .



. . . Dedication of Justin Whiting Plant

America's tremendous power generating capacity did not just happen; it was created and developed by industry. Philip D. Reed, chairman, General Electric Co, made these statements in addressing 600 industry, civic, and business leaders at the dedication ceremonies last month of Justin R. Whiting plant. The dedication ceremonies, said Reed, were really honoring leadership in business development as represented by the organization and growth of Consumers Power.

Reed declared that government-produced power is always "too little and too late." Power needs, he said, must be anticipated five to ten years ahead. Legislators, he added, are more interested in taking care of immediate needs of their constituents than appropriating funds for long-range projects. Private utilities, on the other hand, Reed stated, have done an outstanding job in anticipating and meeting power needs at low cost in a time of unprecedented expansion.

The plant has two 85,000 kw units in operation. They are 3,600-rpm units and will operate at 1,450 psi, 1,000F reheat. A third unit of 106,000 kw is scheduled to go on the line late in 1953.

Interim Contracts

Interior okays pacts for sale of federal power to Georgia Power, Appalachian Electric

Interior Department has signed a stopgap power sales contract with Georgia Power Co for disposal of the power from the federal Clark Hill project on the South Carolina-Georgia border.

This will give Interior additional time to consider terms of a long-term contract for sale of this power under federal power marketing policies.

One effect of the interim contract is to delay a decision on a two-year-old Georgia Power proposal which would permit the company to deliver federally produced power to customers designated by the government (EW, Jan. 26, p 125). This proposed contract, turned down by former Democratic Interior Secretary Oscar L. Chapman, has been interpreted as an abrupt departure from the marketing policies of former Democratic Administrations.

Stopgap Measure . . . In announcing approval of the short-term contract, Assistant Interior Secretary Fred G. Aandahl said it would have no bearing on any future contract. It is viewed as a stopgap measure which will enable the government to dispose of Clark Hill power until permanent arrangements are made.

Under terms of the interim contract, a specified amount of power and energy will be made available to Georgia Power during the period July 15 to Sept. 30. This period may be extended if both parties desire.

The government guarantees to deliver and the company agrees to purchase a minimum of 42,000 kw and 13 million kwhr of power and energy from the project each month during the term of the contract.

Rates . . . The interim rates are on a straight energy basis of 5.5 mills per kwhr for the guaranteed energy and 3.0 mills per kwhr for additional energy that might be made available.

These rates will return an estimated $80,000 per month to the federal treasury. Georgia Power is to furnish all transmission facilities needed to carry out the contract.

Generators now in operation at

Clark Hill have a total of 40,000 kw capacity, and their output is being sold to South Carolina Public Service Authority.

Additional generators to be in service by July 15 will have capacity of 42,000 kw.

Appalachian Contract . . . Interior has also approved a short-term contract between Southeastern Power Administration and Appalachian Electric Power Co for sale of power from the federal Philpott Project on the Roanoke River.

The contract runs from June 28 to Nov. 30. Sepa agrees to furnish 12,000 kw of firm capacity and 1,800 kw of secondary capacity. Demand charge is $1.05 per kw of dependable capacity and $0.50 per kw of non-dependable capacity. Energy rates are 3.5 mills for peaking energy and 2.0 mills for dump energy. Appalachian is to furnish all transmission facilities.

POWER BRIEFS

• **California's Gov Earl Warren** has signed a bill prohibiting soil conservation districts from entering into the power business. Law provides that the soil districts shall not have authority to conserve water for power purposes or to produce or distribute power.

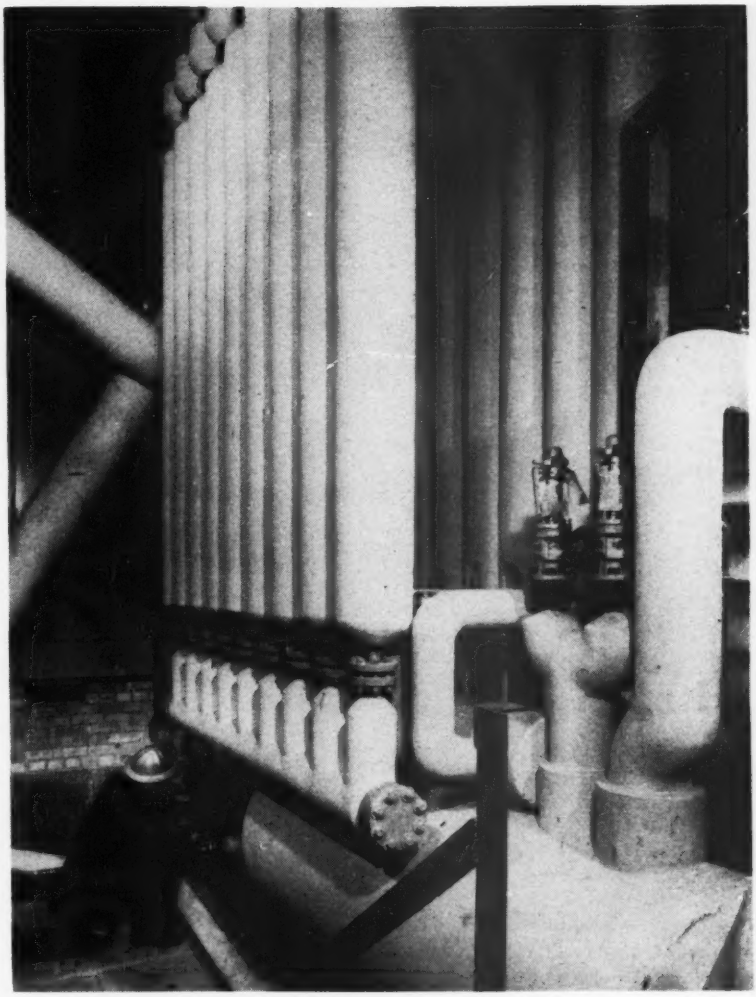
• **Mississippi Power Co** placed in operation last month the second 58,000 hp generating unit at its Plant Sweatt near Meridian. The unit brings generating capacity installed by the company since 1945 to 206,000 hp.

• **Blue Ridge Electric Membership Corp** has received rights from Tennessee Valley Authority to build a dam in Avery and Watauga Counties, if the co-op should desire to do so. The 200-ft Beech Creek Dam would be capable of producing from 41,000 to 82,000 kw. TVA estimated cost of construction at $18.8 million.

• Georgia Power Co has leased a five-story building in Atlanta to be used as its Atlanta division offices and by the main electrical appliance store. The building formerly was owned and occupied by "Atlanta Constitution."

• A transmission line built by Berea College Power Co to serve a service station and housing project just outside the city limits, does not duplicate existing facilities, the Kentucky Public Service Commission has ruled. Blue Grass Rural Electric Cooperative Corp has charged Berea was duplicating its efforts. PSC ruled in favor of Berea on the grounds that the city was going to annex the area and the people asked for Berea power.

• **Shawinigan Water & Power Co** has received Canadian government permission to increase hydroelectric output at three plants by 149,500 hp. Company expects to spend over $10 million to establish these extensions: 40,000 hp at Rapide Blanc; 65,000 hp at Rapide a la Trenche; and 44,500 hp at La Tuque.



Steam from an Atom Breeder

Different from conventional steam generators is this one developed at Argonne National Laboratory, Arco, Idaho, for use with the Experimental Breeder Reactor there. Unique design features prevent the reactor's alkali metal coolant from mixing with water or steam. In contact, they'd react violently.

The unit in conjunction with a turbogenerator supplies 170 kw of power, enough to meet the needs of the reactor and the building in which it is housed. Steam from the "boiler" goes to a superheater, from which it emerges at 550 F and 400 psi, and then to the turbine.

Other items in this week's news will be found starting on page 238.

Elgin B. Robertson, newly-elected president of the American Institute of Electrical Engineers and Donald A. Quarles, retiring president of the Institute, congratulate I. F. Kinnard, General Electric, upon receipt of the 1952 Lamme Medal for his contributions to metering

Summer Meeting Report

AIEE Studies New Power Problems

New problems facing engineers were boldly attacked by AIEE authors at the Summer General Meeting in Atlantic City, June 15-19. As examples, there were: Discussions of atomic power plant design and financing, indications that small hydro sites are being revaluated, tests introduced for spotting puncture-prone insulators, efforts at evaluating transmission losses, a new explanation of corona in capacitor dielectrics. These and other vital subjects occupied 2,500 engineers throughout the meeting's 140-odd technical sessions. Essence of the discussions that took place are reported here.

Financing of Atomic Power Also Feasible

A practicable procedure for financing an atomic plant under the present law was outlined by T. G. LeClair of Commonwealth Edison in a discussion dominantly flavored with economics of nuclear power. His proposal was based on government ownership of the reactor in a plant provided at utility expense with a topping unit and high-pressure boiler to compensate for the low levels of reactor-derived steam. Cost of revision of the plant would be subtracted from the overall total to ascertain the portion to be financed by conventional utility procedures, the rest through government funds. The utility would pay the government the value of the power from the reactor plant in terms of the costs associated with a comparable steam plant minus the utility carrying and operating charges.

An alternative would be for the utility to build an aircraft-carrier form of nuclear prototype with a moderate subsidy to accelerate the know-how and operating experience needed to arrive at a successful commercial project

for either Navy or civilian use. LeClair said, "engineering has advanced far enough to proceed with the design and construction of a nuclear power plant."

Reactor Cost . . . Considerable light was thrown in the other conference papers and discussions on the technology of reactor control but more significant in some respects was the new scale of costs per kw projected for nuclear plants. Costs were estimated to range from $282 to $850 per kw for plants from 554 to 47 Mw. These are power plus plutonium breeding plants. This was so even though T. N. Landis of AEC said it was not yet possible to define the type of reactor that would be best for power generation purposes. He said much of the attitude now was toward focussing on a "power only" reactor rather than one designed to breed plutonium to sell to the government for weapon purposes.

At another power sesion A. E. Knowlton gave a preview of plant and operating costs of 43 new power plants. His data (published in full in this issue of Electrical World) confirmed the 7-mill overall cost frequently cited in the earlier session as the competitive goal of nuclear power.

Boiler-Turbine Outage . . . Outage rates of high-pressure —1000 psi and up—steam turbines and boilers are on the decline. The decline is substantial for high pressure turbo-generators, minor for boilers, according to an intensive report of a subcommittee of the Power Generation and System Engineering Committee. From an outage rate of 1.9% for 1939-44 turbo-generators have dropped to 1.21%. In the same period boiler outage rates dropped from 1.9% to 1.8%, it was reported.

Small Staffs Mean More Boiler Protection

Concensus at a conference session addressed to automatic protective features for boilers and boiler auxiliaries was that the industry is still on the trend of applying protective equipment to compensate for the steady decrease in size of control room staffs. Beyond that agreement the philosophies began to diverge. Some favored extensive resort to automatics, others were intent on keeping the automatic set-up as simple as possible to avoid trouble arising from complexity. Another school was disposed to favor protection directed at avoidance of momentary shutdowns while still another group was minded to protect the expensive generating equipment against expensive damage.

G. R. Hahn and J. A. Brooks, Consolidated Edison, showed how the technique at the Astoria plant was exemplifying the latter school of thought. Hahn had indicated that further types of protection were under consideration but not likely to be applied until the instruments required really became reliable control devices rather than delicate instruments improvised to function as controls.

AG&E system philosophy is to use automatic controls up to the point where it is difficult for the advocates to prove persuasively that what is advocated is really imperative. This applies in particular to low-voltage trips. Each added device, reported H. C. Barnes, introduces

I. W. Gross, American Gas & Electric; G. D. Floyd, Hydro-Electric Power Commission and L. B. Le Vesconte, Sargent & Lundy

D. L. Greene, Gilbert Associates; J. R. Stover, New York State Electric & Gas and F. R. Dallye, Aluminum Co of America

H. J. Scholz, Southern Service Inc; W. A. Lewis, Illinois Institute of Technology; H. G. Barnett and J. K. Dillard, Westinghouse

C. A. Wells, Pacific Tel & Tel; C. V. Roseberry, Westinghouse Electric Corp and George Tenney, editor, Electrical West

L. R. Gaty, Philadelphia Electric Co and Chairman, Summer General Meeting Committee, with Mrs Gaty and J. T. Lusignan, Ohio Brass

C. E. Parks and J. J. Trainor, Public Service Co of Indiana with T. D. Reimers, Consolidated Edison Co of New York

potential sources of false operation. "A simple system involving some calculated risks and reliance upon operators, but easily understood and maintained, is far superior to the complicated one that tries to cover every contingency."

Interlocking . . . At new Delaware Station on the Philadelphia Electric interlocking is kept to a minimum, said E. E. Brown. None, for example, is provided: Between ash collectors and fans; between vanes, dampers and fan motors to prevent starting; to prevent starting of ignition oil or condensate pumps. On the other hand, J. C. Beres and J. A. Elzi said Commonwealth Service's disposition is to provide interlocks so that a motor cannot be placed in operation before the preceding motor in the sequence has been started. A. H. Mergenthaler and H. B. Cox of Southern Services made the point that the electrical interlock system will be less complicated in itself if the station service layout is kept simple.

Small Hydro Sites Need Revaluation

Simple automatic hydro stations using induction generators and full automatic controls are making reevaluation of hydro sites with heads below 50 ft and outputs of 100 to 2500 kw attractive. This thesis was advanced by H. H. Brown, Wisconsin-Michigan Power Co, and A. R. Klann, Allis-Chalmers, in describing details of two such plants: one an 1800-kw 0.8-pf induction generator plant with 35-ft net effective head; the other a 100-kw plant with a 20-ft net head. Most systems have enough synchronous generators in use to permit many such induction machines without impairing excitation or system voltage regulation.

H. E. Rhoades, Northern States Power Co, described what are possibly the first outdoor hydro-electric units to be installed in a climate where temperatures range from —13F to 100F. The plant, below St. Anthony's Falls, Minneapolis, comprises 10 outdoor 875-kva, 800-kw 225-rpm 4160-v vertical units. At this station outdoor installation of synchronous generators offered substantial savings over either indoor installation of similar machines or induction generators in either arrangement. Turbines are 1140-hp, fixed-blade, propeller-type units operating at 23.5-ft head.

Substation Design Tied to Safety, Surge Protection, Grounding

"Safety starts with the basic one-line diagram," reported a working group of the Committee on Substations. They urged simplicity in design to guard against operating mistakes. But the station diagram is only a part of the larger diagram of the interconnected system. The station must be studied in that relationship, they said, if the best design is to be provided.

The natural tendency of station circuits to reduce the magnitude of surges is important in providing lightning protection for EHV substations, said I. W. Gross, American Gas & Electric Service Corp, L. V. LeVesconte, Sargent & Lundy, and J. K. Dillard, Westinghouse Electric Corp. Analogue computer investigations showed that a single

lightning arrester on the line terminal of a substation bay failed to protect the transformers but that one arrester at the junction between two transformers protected the entire bay. As bays were added, surge voltage declined, but good judgement dictates use of a few arresters, they said.

Grounding for protective equipment was discussed in two papers. The first, by E. T. B. Gross, Illinois Tech, B. V. Chitnis, American Gas & Electric Service Corp, and L. J. Stratton, Armour Research Foundation, analyzed ground grids. They showed that the area of the grid should be as large as possible but the number of meshes is less important. It should be buried as deep as excavation costs permit, but the size of conductor is not important.

In discussion, W. A. Morgan, Ebasco Services, cautioned that certain soils contain chemicals which attack ground conductors. Such conditions, he said, should be evaluated as they could preclude use of small conductors for economy.

The second paper, by J. Zaborszky and J. W. Rittenhouse, Missouri School of Mines, advocated deep-driven grounds for the optimum use of material. This was substantiated by C. L. Jensen, Copperweld Steel Co, who recommended measuring each section as it is driven until the desired resistance is obtained.

Heat Flow In Soil . . . Important new light was shed on the dissipation of heat into soil from buried cable by W. A. Hadley and R. Eisenstadt of Columbia University. Using radioactive cobalt salt, they traced moisture movement in a laboratory model of cable buried in sand. They found that moisture in wet soil takes on a circulatory motion to carry away heat. But when the moisture drops below a critical 4% it migrates away from the cable to permit a sharp rise in temperature. Thus they explain the condition known as "runaway." Extending these tests to other soils was urged by several.

A trend toward single-phase oil reclosers at substations for switching distribution circuits was found by a working group of the Substation Committee. And three-phase oil reclosers are gaining in use, they reported. But automatic reclosing circuit breakers continue to be applied for heavy interrupting duties and load currents. Over 80% of the users inspect these devices on a regular schedule, they found, usually at intervals of one to four weeks.

Need Steeper-Front Arrester Test Wave

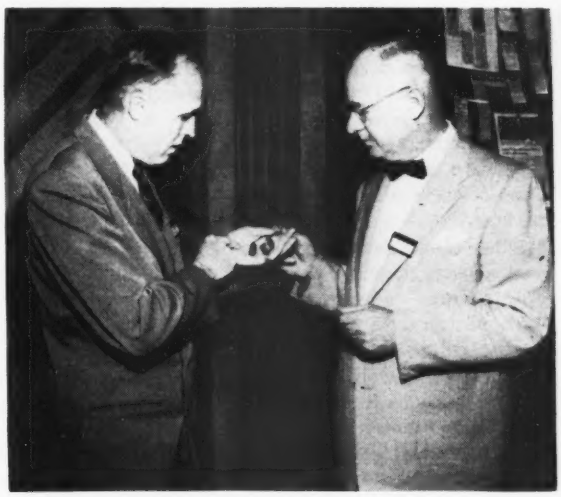
Proposal to shorten the present 10-microsecond front of the standard arrester current test wave and so achieve a discharge voltage wave front approximating the 1.5 x 40 microsecond voltage wave used as standard for establishing impulse withstand level of equipment was made by H. A. Cornelius, Public Service Co of Northern Illinois. He said the change would make unnecessary any further increase in arrester discharge voltage to offset effect of steep front in severe lightning strokes, 99% of which fall within a 5,000 amp per microsecond rate of rise to a crest of 5000 amp.

In discussion K. H. Kidd, General Electric, noted that a 5-ms current test front was about the shortest available. H. L. Rorden, Bonneville Power, concurred with Cornelius that the prevailing 10 x 20 microsecond current test wave doesn't serve the user adequately. But he said no

(*Continued on page* 204)

A. P. Hayward, Duquesne Light; W. R. Brownlee, Southern Services and O. J. Miller, Duke Power vice-president and general manager

G. B. Dodds, Duquesne Light; Kenneth Wyatt, Phelps Dodge Copper Products, and E. R. Thomas, Consolidated Edison



J. R. Macintyre, General Electric showing a 1.2 in. long servo-motor to Walter B. Morton, Pennsylvania Power and Light Co

Here's how the utilities spent their advertising dollars in 1952

	ELECTRIC UTILITIES % of Total Advertising Expenditures of Co's Reporting Item				COMBINATION UTILITIES % of Total Advertising Expenditures of Co's Reporting Item			
	Avg.	Max.	Min.	Median	Avg.	Max.	Min.	Median
Newspaper Advertising Space	33.6	78.6	10.2	34.3	32.0	100.0	11.7	34.0
Prod. Cost for Newspaper Adv	4.4	9.8	0.2	3.5	6.6	20.6	0.1	5.0
Radio	6.7	33.9	*	6.3	6.9	38.1	0.1	8.5
Television	6.4	18.2	0.1	4.3	5.9	22.2	*	3.6
Billboard and Poster	3.4	15.8	0.2	2.6	4.3	16.6	*	2.6
Direct Mail	4.5	34.4	0.2	4.4	4.2	13.2	0.1	3.0
Window and Showroom Display	3.7	18.7	0.3	1.8	3.5	14.4	0.2	2.4
Exhibits and Fairs	1.9	19.3	0.1	1.2	1.4	6.2	0.1	1.2
Motion Pictures	0.5	4.9	*	0.4	0.8	4.7	0.1	0.5
Miscellaneous Catalogues	2.6	11.3	0.1	2.3	2.4	13.7	0.2	2.1
Dealer Helps	1.3	17.9	0.1	0.9	2.6	10.7	0.1	1.4
Employee House Organ	5.9	24.1	0.6	5.7	4.8	14.4	0.2	4.9
Bill Inserts	6.0	18.7	0.6	4.8	7.4	29.7	0.1	2.3
Stockholder Annual Reports	4.6	18.1	0.6	3.9	4.8	27.0	0.6	5.9
Salaries	15.2	43.9	3.1	12.7	14.6	55.3	3.2	13.6
Stationery, Supplies, Misc.	2.9	9.3	0.2	2.2	2.6	11.6	0.1	1.5
Association Advertising	7.3	32.7	0.8	8.3	8.4	28.7	*	8.7
Agency Commission	3.1	16.2	0.3	3.5	3.1	16.0	0.3	3.5
Surveys	2.5	6.0	0.1	2.0	1.0	6.9	*	1.4

Note: * Less than 0.05%

Ad Expense Nears $1 per Customer

Electric companies on the average are spending 91¢ per customer per year for advertising. This is 0.6% of their gross revenue. This was revealed by the "1952 Analysis of Utility Advertising and Public Relations Expenditures" recently distributed by the Public Utilities Advertising Association to its members.

The survey has been conducted annually since 1946. The latest was directed by Robert H. Bridges, advertising manager, Cleveland Electric Illuminating Co. Data were supplied by 59 electric companies, 65 combination companies, and 74 gas companies. In the United States these companies serve approximately 60% of all electric and 66% of all gas consumers and collect 70% of the electric revenues and 73% of the gas revenues.

Other significant facts in the 1952 analysis were these:

1. Average advertising expenditures per customer for all gas and electric utilities increased 10% from 73¢ in 1951 to 80¢ in 1952.

2. Average advertising expenditures as a percentage of gross revenue for all gas and electric utilities remained 0.62%, the same as in the two previous years.

3. Gas companies again devoted more of their gross revenue to advertising than either electric or combination companies, but their average percentage was off sharply from 1951.

4. Newspaper space advertising decreased in percent of total advertising for the second successive year.

5. On the basis of only those gas and electric companies reporting the item, salaries increased from 11.8% in 1951 to 13.9% of total advertising expenditures.

6. Among those companies reporting use of television, percent of total expenditure devoted to television advertising slipped from 6.9% in 1951 to 6.7% in 1952. On the same basis, the percentage allocated to radio advertising dropped to 6.9% from 7.4% in 1951.

7. Percentage of total advertising spent for billboards and posters and for agency commissions decreased while that for association advertising increased.

8. Combination companies spent almost 9% of their expenditures for newspaper advertising space on national advertising.

9. Electric utilities spent over 16% more of their advertising dollar for cooperative advertising than did either gas or combination utilities.

10. Combination utilities spent almost half of their institutional advertising budget for low price advertising. Gas utilities spent 72% of their institutional advertising dollar for company service and area development advertising.

11. Utility advertising expenditures for all gas and electric utilities are expected to increase 5.3% in 1953.

Trend of Utility Advertising Expenditures

Type of Company	1952	1951	1950	1949	1948	1947	1946	1940
Dollars of Advertising per Customer								
Electric	0.91	0.85	0.82	0.82	0.82	0.76	0.83	0.63
Combination	0.72	0.66	0.64	0.60	0.57	0.56	0.44	0.48
Advertising Expenditures as Per Cent of Gross Revenue								
Electric	0.60	0.58	0.59	0.62	0.62	0.61	0.74	0.68
Combination	0.57	0.57	0.58	0.59	0.54	0.58	0.52	0.64

WASHINGTON COMMENT

JESSE MOCK

No Tears Shed For Depa, But—

This is no time to shed a sentimental tear over the quiet passing of Defense Electric Power Administration.

The materials control agency for the electric power industry was born of necessity back in 1950. It closed shop under similar circumstances June 30 of this year.

But before you write it off as just another federal agency mixing into the affairs of the industry, it is worthwhile to consider some of its contributions. Its record may be as valuable in the future as was its day-to-day contributions during its existence.

Strictly on the allocation work, Depa was never able to get enough materials to permit utilities to equal previous records for annual installation of new capacity. Some will even argue that the industry would have fared better without materials controls. Qualifications of such an argument, however, are such that it has no validity.

Much-Praised Agency . . . Long-range contributions of Depa are still to be tested, but the record of the agency indicates they will measure up. Few government agencies have received the commendations from both Congress and the Administration that Depa has. This recognition is bound to aid electric utilities during future quests to Washington.

Operation of Depa has shown that:

- Representatives of public and private utilities can work together with mutual respect for the mutual benefit of the industry.
- The industry is a key to any defense production effort.
- There are men in the industry who are well equipped both by experience and personality to assume government duties of this type.

For all practical purposes, the wasteful private-vs-public power controversy was shelved at Depa. Engineers and administrators who came from both sides attempted to make decisions on the merits of a case without regard to this controversy.

Public power men, for example, handled all decisions relating to tax amortization certificates for electric companies. While there were delays, there were no public accusations that they had not acted fairly as between company applications. This arrangement, no doubt, will stave off future arguments from public power advocates that the tax program was mishandled.

No responsible segment of the industry has accused Depa of acting unfairly. Teamwork, rather than bickering, has characterized the efforts of the private and public power men who have worked at Depa. If there were squabbles, they were family squabbles with a minimum of bitterness.

"Education Program" . . . Biggest battle of Depa was to gain recognition from other control agencies of the importance of the electric industry. This objective, which is so obvious to the industry men that it gets little consideration, was not all obvious to government control officials. They could not understand why electricity cannot be rationed on the same basis as coffee, or why orders for heavy equipment must be placed years in advance of delivery.

Depa had to undertake an extended educational campaign to rescue steel and copper from ash trays and wastebaskets so it could be put into generators and transformers. It was similar to putting a child through first grade, and just as necessary.

This campaign paid off. Congress recognized the strategic importance of electric energy as did other agencies. A series of Congressional and agency reports finally lead to a materials priority program for the industry which equalled treatment the Defense Department and the Atomic Energy Commission.

Directing much of this educational program was James F. Fairman, the Consolidated Edison Co vice president who took Depa through its toughest fights. Fairman won the respect of Congress, his superiors at the Interior Department, as well as all importment segments of the public and private power industry.

The record which Fairman made in Washington is a credit to himself and his company. It is also representative of the many other outstanding officials which electric companies loaned to the government during the Korean emergency.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Prestressed concrete has been used in Europe for 20 years. Cracks so common in reinforced concrete are avoided because prestressing substitutes a degree of decompression when loadings apply tension.

Generators with high short-circuit ratio and equipped with high-speed voltage regulators can advantageously be operated at unit p.f. or even under-excited during periods of light system load.

High voltage primaries logically call for larger secondaries for economic balance.

Power system ground fault near pilot wire terminal can cause incorrect relaying and damaged pilot wire protective blocks. Neutralizing transformers in pilot wire circuit can minimize this hazard.

Electrical precipitators ahead of the mechanical apparently cost a bit more and achieve a higher take in a few cases but the reverse arrangement has more devotees. The dissent is worth fathoming.

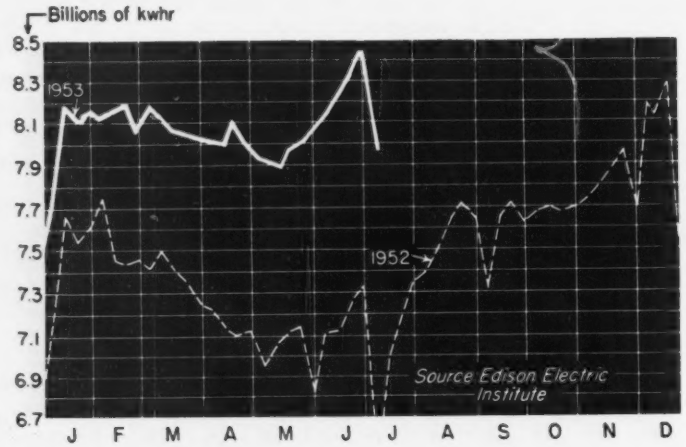
Wing plates attached to the U-blade of a bulldozer increase the "move" capacity within the capability of the machine.

Fresh oil in a transformer will have shorter life than the oxidized oil that it replaces if the residual deterioration products in the insulation are not flushed out completely in making the change.

Trains were stopped for 10 minutes on Sweden's railways to permit tests on earth return of high voltage dc power currents. Risk of faulty action of railway signals was averted by the cessation. Resistance for 687 miles was found to be 0.45 ohms.

Full wave strokes on a phase conductor will probably be one-sixth as frequent as chopped waves.

STATISTICS



Output Week Ended July 4—7,970,000,000* Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
July 4	+23.0*	(Regional changes not available at press time)								
June 27	+15.4	+16.3	+12.6	+20.3	+11.6	+17.3	+14.1	+10.8	+13.7	+11.8
June 20	+14.8	+15.1	+9.2	+20.6	+16.0	+18.7	+16.7	+7.7	+10.9	+7.4

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Apr.	72.9	73.5	65.4
Capacity (Million Kw)	Apr.	83.84	83.17	76.74
Production (Billions Kwhr)	Apr.	35.63	36.97	31.51
Hydro		9.70	10.20	9.96
Fuel		25.92	26.77	21.55
Fuel Consumption				
Coal (Million Tons)	Apr.	8.91	9.44	8.05
Oil (Million Barrels)		7.15	8.08	4.20
Gas (Billion Cu Ft)		76.58	70.16	66.50
Sales (Billion Kwhr)	Apr.	31.75	31.73	28.33
Residential		8.86	9.10	7.91
Commercial		5.15	5.18	4.74
Industrial		15.46	15.36	13.85
Other		2.28	2.09	1.83
Net Income Class A & B Companies ($ Million)	Mar.	90.61	98.39	84.32
Estimated Dec. '53 Peak (Million Kw)	Apr.	86.5	86.5	88.6
Kwhr per Residential Customer (12 Month Average)	Mar.	2,209	2,195	2,053
Revenue per Kwhr Residential Service (12 Month Average)	Mar.	2.76¢	2.76¢	2.79¢
Canadian Production (Billion Kwhr)	Apr.	5.75	5.78	5.03

Business Statistics

FRB Industrial Production Index†††	May	241*	240	211
Gross National Product Annual Rate ($ Billion)	4th Qtr.	355.2	343.0	337.1
EW 5 Industry Production Index	May	129.6	130.2	116.0
ENR Construction Cost Index††	June	124.4	123.5	117.8
BLS Consumer's Price Index	Apr.	113.7	113.6	112.9
NEMA Insulation Materials Sales Index†	Apr.	694	694	545
NEMA Electric Appliance Sales Index†		317	356	211
NEMA Household Refrig. Sales Index†		188	211	133
Metal Prices (June 23)				
Copper, Conn. V., lb		$ .29¾-.30	$ .29¾	$ .24½
Lead, N. Y., lb		.13½	.13¼	.16
Zinc, prime Western E. St. Louis, lb		.11	.11	.15
Tin, Straits, qual. N. Y. lb		.83¾	.92¾	1.21½
Aluminum, ingot, base price		.20½	.20½	.19
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		41.00	45.00	45.00

*Preliminary **Revised †1936=100 ††1949=100 †††Unadjusted

Latest on Population From "the Census"

Substantial increases in the number of preschool-age and elementary school-age children between April 1, 1950, the date of the last census, and July 1, 1952 are reflected in estimates just released by the Bureau of the Census.

In addition, an increase in the aged and a decline in the number of young adults have taken place. Most striking growth of any age group was that of the 5 to 9 year olds which increased 1.7 million or 13.1% in this period.

Population—Thousands

	April 1, 1950	July 1, 1952
Under 5	16,164	17,144
5 to 9	13,200	14,929
10 to 14	11,119	11,764
15 to 19	10,700	10,630
20 to 24	11,651	11,323
25 to 29	12,318	12,189
30 to 34	11,575	11,990
35 to 39	11,274	11,424
40 to 44	10,217	10,723
45 to 49	9,075	9,472
50 to 54	8,274	8,483
55 to 59	7,236	7,516
60 to 64	6,060	6,292
65 to 69	5,003	5,161
70 to 74	3,412	3,760
75 to 79	2,152	2,269
80 to 84	1,125	1,232
85 and over	577	679
All Ages	**151,132**	**156,981**
Medium Age	**30.2**	**30.2**

Source: Estimates of the Bureau of the Census. Includes armed forces overseas.

Increases in the school-age population are currently being reflected in increases in enrollment in elementary grades. The Bureau believes that enrollment will continue to increase at the rate of approximately one million a year for the next several years.

About 32 million persons were enrolled in school or college at the beginning of the 1952-1953 school year, an increase of 1.4 million over October 1951.

Population including the armed forces overseas was about 159.3 million on May 1, 1953, according to the Bureau. This is an increase of 2.7 million or 1.7% over May 1952 and 8.1 million, 5.4%, over April 1, 1950.

Total population in the United States was, on Dec. 1, 1952, 156.9 million; including armed forces overseas 158.3 million.

FINANCIAL

FPC Drafts Accounting Change

Commission proposes amendment which will provide for reporting tax savings under accelerated amortization

Federal Power Commission has proposed an amendment to the Uniform Systems of Accounts Prescribed for Public Utilities and Licensees and Natural Gas Companies and of Annual Reports, Forms Nos. 1 and 2, which will provide for accounting and reporting of "Provision for Future Income Taxes Resulting from Accelerated Amortization" as permitted under Section 124A of the Internal Revenue Code.

Proposed Changes . . . This proposed amendment would:

1. Add a new account "539 Provision for Future Income Taxes Resulting from Accelerated Amortization," at page 88 of the Uniform System of Accounts, immediately below what is now termed "Net Income" appearing below the designation of Account, "538 Miscellaneous Deductions." Because of this change, the term "Net Income" would be changed to "Net Income before Provision for Future Income Taxes." Another new title would be added, "Net Income After Provision for Future Taxes."

2. Add the following new paragraph to the text on page 95 of the Uniform System of Accounts, Account, "539, Provisions for Future Income Taxes Resulting from Accelerated Amortization":

"Where a utility elects or is directed to set up a reserve by a commission for future income taxes by reason of claiming accelerated amortization under Section 124A of the Internal Revenue Code, there shall be charged to this account each year an amount equal to the reduction in income taxes due to the deduction of accelerated amortization. Concurrent credit shall be made to Account 259, Reserve for Future Income Taxes Resulting from Accelerated Amortization.

"After the period of accelerated amortization is terminated, credit to this account each year an amount equal to the amount accumulated in Account 259, divided by the average estimated remaining service life of the property, or such other amount as may be fixed by the commission, with concurrent debit to Account 259, Reserve for Future Income Taxes Resulting from Accelerated Amortization."

3. Add at page 17 a new Account 259 to the Uniform System of Accounts, "Reserve for Future Income Taxes Resulting from Accelerated Amortization."

4. Add the following paragraph to the text on page 36 of the Uniform System of Accounts. Account, "259, Reserve for Future Income Taxes Resulting from Accelerated Amortization":

"Credits and debits shall be made to this account as provided in the text of Account 539, Provision for Future Income Taxes Resulting from Accelerated Amortization.

"Any balances remaining in this account after the retirement of all property constructed under a particular certificate of accelerated amortization, shall be disposed of as directed by the commission."

Oral Arguments Scheduled . . . FPC has set Sept. 9 for oral arguments on the amendments. The commission has also asked interested persons to submit data, views, and comments in writing concerning the proposed amendments not later than Aug. 19.

The Committee on Accounts and Statistics of the National Association of Railroad and Utilities Commissioners held a meeting on April 7-9 and adopted the following:

"A substantial majority of the committee have agreed upon a method of presentation, which reconciles the various views as far as possible. This presentation provides for two new accounts. One will appear upon the income statement immediately following Net Income and preceding the section showing Disposition of Net Income. This account will reflect the debits for taxes which would have been payable without the accelerated amortization during the five-year period and the credits representing more or less exactly the increases in income taxes during the period following the period of accelerated amortization. Its interpretation in the financial statements and for rate purposes may vary according to the opinion of the reader. The other new account appears upon the balance sheet following Account 258, Other Reserves, and preceding Account 261, Contributions in Aid of Construction, the various surplus accounts. This account contains the offsetting credits for the charges made to the first account during the period of accelerated amortization and is reduced by credits during the succeeding period over either the life of the property or an arbitrary period more or less approximating that life fixed by the regulatory commission."

The committee further stated "that Messrs Orton and Smith were delegated to prepare a draft of proposed texts of accounts and an accompanying letter for distribution by the chairman. This has been done, and regulatory commissions and all members and conferees of the committee have been sent such suggested accounts."

Another meeting of the committee is scheduled to be held beginning tomorrow July 14, continuing through July 16.

FINANCIAL BRIEFS

Standard Power & Light Corp will call for redemption on Aug. 1 the remaining 12,766 shares of cumulative preferred stock. Holders will receive $214.65 for each share of which $104.65 represents accumulated dividends. The company has received approval from SEC to borrow up to $2½ million to redeem the balance of preferred shares and entered into a one-year loan agreement with Hanover Bank of New York for that sum at 3½% interest.

International Hydro-Electric System, Boston, has filed a compromise plan with Securities & Exchange Commission which calls for the company to be converted into an investment concern, rather than be dissolved. Plan further provides that preferred stockholders get 5½ shares of Gatineau Power Co, an IHES Canadian sub-

sidiary, for each of their shares. SEC staff is expected to recommend that the plan be accepted at a hearing expected sometime in August.

New York State Electric & Gas Corp has acquired electric generating and other facilities of the Saranac Division of Eastern New York Power Corp for $5,600,000. Properties are located in the vicinity of Plattsburgh. The utility has also received approval from the Public Service Commission for a 25-year franchise granted by the village of Hamburg, N. Y., for transmission and distribution of electricity. Franchise replaces one given the company in 1913, expiring this year . . . Niagara Mohawk Power Corp has completed the purchase of a number of hydroelectric power sites and properties of Eastern New York Power Corp and the International Hydro-Electric System for $8.5 million.

"The Allyn Analyst," published by A. C. Allyn & Co, names the New England Gas & Electric Association as the "Utility of the Month" . . . Equitable Life Assurance Society of United States has bought 10,000 shares of 5.25% preferred stock of the Long Island Lighting Co . . . Insurance Co of North America has purchased 7,000 shares of 4.68% preferred stock of Philadelphia Electric Co and has sold 1,000 shares of 4.20% preferred stock of the West Penn Power Co.

Stockholder Subscriptions: Western Light & Telephone Co's common stockholders subscribed for 58,790 shares of 5½% convertible preferred stock of 78,202 shares offered on the basis of one share of preferred for each five shares of common held of record on June 17 at $25 a share. Remaining 19,412 shares were taken by Harris, Hall & Co and reoffered at $25.375 a share . . . Of 45,254 shares of common offered to stockholders by Bangor Hydro-Electric Co, 43,326 shares were subscribed for on a 1-for-6 basis at $25. Remaining 1,928 shares were allotted to stockholders under their oversubscription privileges . . . About 64% of 568,565 shares of common offered by General Public Utilities Corp on a 1-for-15 basis at $23.50 were taken up on rights. Balance was sold to stockholders under a "rounding-out preference privilege" and to others under a dealer compensation arrangement.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
July 2	**3.32**	**3.40**	**3.61**	**4.39**	**4.63**	**4.85**	**5.46**	**5.85**	**6.06**
June 25	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
END OF QTR.									
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Arizona Public Service	12	May	$3,462,000	$2,678,000	$....	$....
California-Pacific Utilities	12	May	538,387	509,949	2.00	1.91
Consolidated Gas Electric Light & Power	5	May	5,578,351	4,624,328	1.02(a)	0.84(a)
Consumers Power	12	May	21,959,849	19,830,848	2.74(b)	2.67(b)
Dallas Power & Light	12	May	4,537,458	3,557,554	....	....
Gulf States Utilities	12	May	7,852,247	6,196,119	1.63	1.25(c)
Kansas City Power & Light	12	May	6,196,795	4,899,159	....	....
Public Service Co. of Indiana	12	May	10,804,311	9,117,556	2.51(e)	2.34(e)
Tampa Electric	12	May	2,528,593	1,861,554	3.52(f)	3.11(f)
Texas Electric Service	12	May	8,427,343	7,440,544	....	....
Texas Power & Light	12	May	8,217,785	6,785,627	....	....
Virginia Electric & Power	12	May	12,106,708	11,148,396	1.81(g)	1.79(g)

Notes—(a) Based on average number of shares outstanding in 1953 and 1952; (b) Based on 6,794,362 shares in 1953 and 6,176,693 shares in 1952; (c) Restated to give effect to 5 to 4 split effective May 7, 1953; (e) Based on 3,780,768 shares in 1953 and 3,579,359 shares in 1952; (f) Based on 658,441 shares in 1953 and 598,441 shares in 1952; and (g) Based on 5,441,034 shares in 1953 and 4,952,565 shares in 1952.

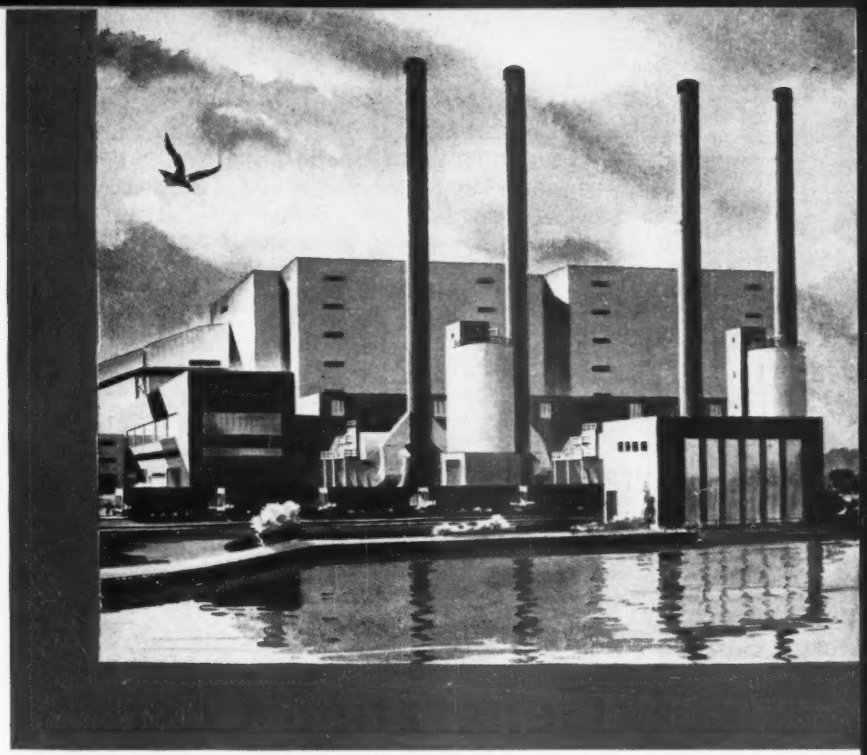
FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF JULY 2-8			
Bonds			
Commonwealth Edison—1st mtg 3⅝% due 1983	$40,000	100.00%	3.625%
SCHEDULE FOR JULY—AUGUST—SEPTEMBER			
Bonds			**Bid Date**
Consumers Power—1st mtg due 1983	$25,000	.....	July 16(b)
Western Light & Telephone—1st mtg due 1983	3,000(c)	.....	July 21
Louisiana Power & Light—1st mtg due 1983	12,000	.....	Sept. 15
Metropolitan Edison—1st mtg due 1983	8,000	.....	.....
Southern California Edison—1st mtg	30,000	.....	.....
Nova Scotia Light & Power—1st mtg	2,100	.....	.....(f)
Debentures			
Central Hudson Gas & Electric—conv debs	$6,000	.....	.....
Common Stock			
Boston Edison—246,866 sh (to be offered commonholders on 1-for-10 basis record July 16 to expire Aug. 3 with an over subscription privilege)	.....	.....	.....
Central Hudson Gas & Electric—140,000 sh (to be offered commonholders on 1-for-15 basis)	.....	.....	.....
Nova Scotia Light & Power—53,260 sh	.....	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Eastern Utilities Associates—collateral trust	$7,000	.....	.....
Monongahela Power—1st mtg	10,000	.....	.....
Public Service Electric & Gas—1st mtg due 1983	50,000	.....	.....
Kansas Gas & Electric—1st mtg due 1983	10,000	.....	.....
Southern Indiana Gas & Electric—1st mtg	5,000(e)	.....	.....
Preferred Stock			
Kansas Gas & Electric	$5,000	.....	.....
Common Stock			
Iowa-Illinois Electric & Gas	6,000(a)	.....	.....
Wisconsin Power & Light (probably on a 1-for-7 basis)	.....	.....	.....
Wisconsin Public Service	.....	.....	.....
Western Massachusetts Co	4,000(e)	.....	.....

Notes—(a) To sell enough common stock to yield $6 million; (b) Morgan Stanley & Co will offer the bonds to the public in a negotiated deal; (c) Harris, Hall & Co group, underwriters; (e) Estimated; and (f) Royal Securities Corp will be the principal underwriter.

A Survey

Embracing 43 new power plants totalling 6800 Mw of capability



8th Steam Station Cost Survey

A. E. KNOWLTON, Senior Associate Editor, Electrical World

Whether cost of building and operating generating plants during 1952 was higher or lower than it was in 1950 is definitely a matter of concern among owners and designers of the plants. Light on this question is derivable from data compiled from 43 new plants aggregating 6,800,000 kw. These plants in 1952 generated more than 34 billions of kilowatthours and in the process consumed some 9,900,000 tons of coal, 5,600,000 barrels of oil and 102,739,000 M cu ft of natural gas.

From this comprehensive, authoritative and exclusive data it is possible to derive the following conclusions:

1. A kilowatthour at the bus in new plants in 1952 cost 3½ to 7 mills, average 6¼ mills overall.

2. Plants for operation in 1952 were built generally for $90 to $165 (extremes $75 to $205) per kw.

3. Plants for burning coal ranged from $100 to $165, for oil $145 to $150 and for gas $90 to $135.

4. Fuel for power plants is cheapest in the south central states where gas costs are as low as 9½ cents per million Btu.

5. Oil generally costs more than coal on an equal thermal basis and pronouncedly so where used only for ignition purposes.

6. Reheat cycles consistently show from 4% to 24% better thermal performance than the non-reheat plants.

7. Heat rates for 2,000-psi plants with reheat are 25% superior thermal-wise to 900-psi plants without reheat.

8. Reheat is universal choice above 1,400 psi.

9. Utilization factors based on capability ratings average about 105% showing still usable margins above the guaranteed or stated capabilities.

10. Plant factors were some 10% lower (at 70%) in 1952 than they were in 1950.

11. Fuel constitutes 80% of the production cost.

12. Labor and superintendence comprises only 10% of total production cost.

13. Kilowatts per plant employee remain unchanged in plants aggregating 150 Mw or more.

14. Kilowatts per employee have been increased from 30 to 100% in plants aggregating 40-100 Mw.

15. Consumption for plant auxiliaries seems to be unexplainably independent of the fuel used but is definitely low for reheat plants.

16. Outdoor plants (sometimes involving outdoor turbogenerators as well as boilers, fans and air preheater) save from $5 to $25 of investment per kilowatt.

17. Coal handling facilities involve investment of $1 to $3 per kilowatt.

18. Coal stored for emergency runs about ¾ ton per kilowatt, actually more where other fuels are also used than where coal is the only fuel.

19. Maintenance cost per kwhr in 1952 has been reduced very slightly from 1950.

20. Largest single maintenance item is the boiler account, least in this group is the electrical equipment account.

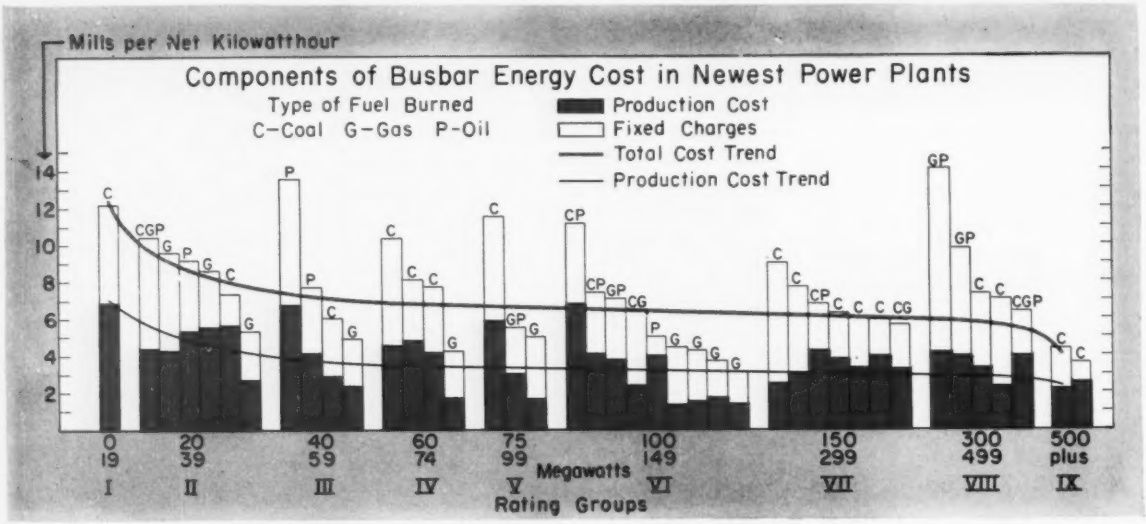


FIG 1—Production costs average just above 3 mills and total cost 6.2 mills for plants above 50 Mw capability

Generating Costs Stabilized

Production costs still stand at 3 to 4 mills in new plants. Trend to gas fuel and outdoor designs continue. Lowest costs are associated with that combination

It was still possible in general in 1952 to produce a net kilowatthour in modern stations of average size for 6 to 7 mills. Best of the largest stations do it at 3½ mills including the fixed charges. Plants down to 40-60 Mw average up toward 6½ mills. These figures are apparently lower than those attained during 1950. It is only fair to admit, however, that two factors have contributed to the slight decrease. One is the more general use of capability figures for machine ratings. This decreases the cost per kilowatt of capacity and to some extent cost per kilowatthour. A second factor is the use of the fixed charge percentage employed by the reporting utilities rather than the uniform 15% employed in previous surveys. The range is from 6% for a governmental unit to 16%, the high reported by a private utility. Average value for 30 instances is 12.8. Due to this readjustment the fixed charges are sensibly equal in magnitude to the production costs, but slightly preponderant in the smaller plants.

In Fig. 1 a small group of plants associated with hydro systems has been omitted in establishing the trend curves to avoid distortion attributable to load factors out of line with more representative plants.

Table I—Four Out of 10 New Plants Burn Only Coal, One-fourth Gas

Megawatt Range	0–19	20–39	40–59	60–74	75–99	100–149	150–299	300–499	500+	Total
Coal	1	1	1	3	1	0	5	2	2	16
Gas	0	3	1	1	1	4	1	0	0	11
Oil*	0	1	2	0	0	1	1	0	0	5
Coal and Gas	0	0	0	0	0	1	0	0	0	1
Coal and Oil*	0	0	0	0	0	3	0	0	0	3
Gas and Oil*	0	0	0	0	1	0	0	2	0	3
Coal, Gas, Oil*	0	1	0	0	0	0	0	1	0	2

*Light-off oil not included

Production Charges . . . Taking plants from 40 to 300 Mw the overall production costs range around a 3-mill average. Those blessed with gas as a fuel show as little as half this amount. On the other hand some burning oil, or oil and coal, reflect double the 3-mill average cost for all fuels. Whatever the fuel, the production cost, and fixed charges are about equal components of the total bus bar cost of the net kilowatthours.

The very largest plants exhibit the lowest overall cost of generation because they are designed for superior thermal economy and achieve this with advantageously low investment per kw despite the fact that they burn coal and have the investment to carry in coal and ash handling facilities.

Fuel Influence . . . Proportion of plants relying on oil as fuel has decreased; natural gas and coal have held the same approximate position as in 1950. Forty percent of the plants burn coal; 25% burn gas exclusively but another 15% burn gas in conjunction with other fuel. Oil is the fuel in only one in eight plants. Other than for light-off purposes it is used in one of five other plants.

Number of plants burning two or more fuels has increased proportionately. This status is as much an index of the areas with most rapidly enlarging demands as of economic preference for a particular fuel. Gas is becoming more widely available but at steadily rising unit cost.

Choice (or perhaps availability) of gas usually, however, happens in the Southwest where climate is favorable to outdoor installation of boiler, fans, air preheater and even the turbogenerator. Plants designed primarily to burn gas have no burden of fuel storage, no fuel handling or storage, no ash, no smoke and a minimum of boiler maintenance to worry about. Omission of facilities for these functions along with the outdoor installation of equipment saves up to $50 investment per kilowatt. One gas burning plant cost as little as $75 per kw for its 100 Mw of capability.

Plant Costs Down Several Percent

Costs are still, however, 50% to 60% above prewar levels. Boilers and turbogenerators account for 60% of the total cost, buildings less than 20%

Average stations cost $130-135 against a $145-150 figure in 1950. The 1952 data are, of course, for plants that were largely designed and built in the 1948-1951 period and to that extent do not reflect 1953 price levels. But that there was a reduction during the postwar period when labor and materials rose in an inflationary environment is a testimonial to the skill of the designers. Some of the gain is due to the incorporation of larger generators at lower costs per unit of capability. Some is due to centralization of control, some to outdoor design, some to adoption of higher steam conditions (more output per pound of metal).

The higher unit costs found in 1950 for the largest plants were not encountered in these 1952 data. Then they were attributed to the inevitably higher costs for construction in congested metropolitan and industrial areas. The large plants in the present compilation reflect some of the tendency to avoid concentration of generating capacity in limited areas where industry and population has already congregated.

Impact of Fuel Cost . . . As has always been the case, because it is a logical consequence, the plants confronted with the highest fuel costs are the ones on which the most money is spent for efficiency. Where fuel is as cheap as 10 cents per million Btu the typical plant entailed an investment of about $120 per kilowatt. Where fuel is as expensive as 35 cents the plant outlay comes near to $135 per kilowatt. The same design philosophy appears in an analysis of the Btu-per-net-kwhr attained in operation of the plant. Over the same range of 10-35 cents the Btu figures are 12,000 to 11,500 respectively. Interpreted in other terms the statistics indicate that one-eighth more is spent for plant refinement to achieve a 4% betterment in fuel consumption. These are average indications and would not

(*Continued on page* 128)

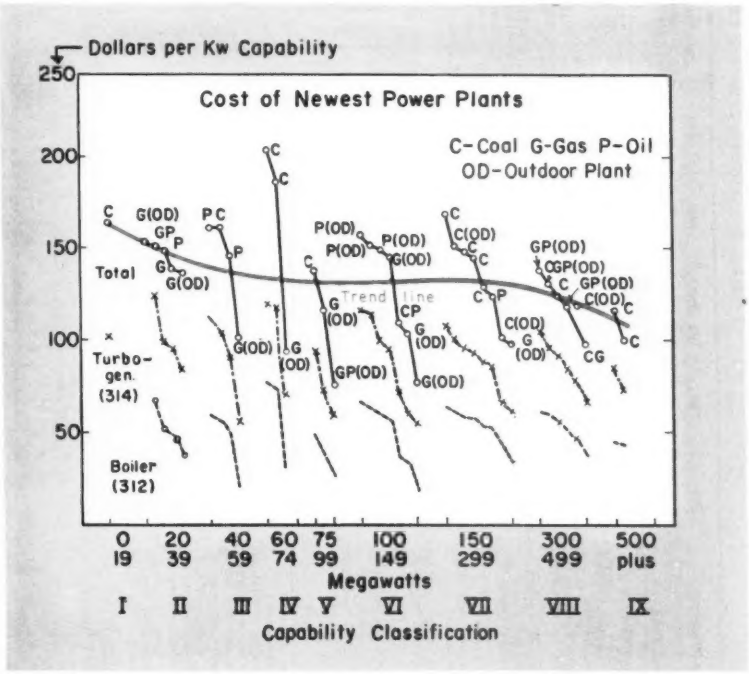


FIG. 2—A kilowatt of capability costs from $75 in an outdoor plant burning gas to $200 for an enclosed plant burning coal

TABLE I—Steam Station Equipment Data and Production Costs (1952)

Station Number	191	192	193 (144)	194	195	196 (146)	197	198	199	200	201	202 (162)	203	204	205	206
General Data																
Normal function[1]	(a), (d)	(a)	(d)	(a)	(a)	(d)	(a)	(d)	(d)	(d)	(a)	(d)	(a)	(a)	(a), (c), (d)	(a), (d)
Year, initial operation	1951	1950	1948	1951	1950	1948	1951	1950	1952	1952	1951	1949	1951	1948	1950	1951
latest unit	1953	1952	1951	1951	1951	1952	1952	1952	1953	1952	1952	1952	1951	1951	1950	1952
Total gen. rating (nameplate)[2]	IX	IX	VIII	VIII	VIII	VIII	VII	VIII	VII	VII	VI	VI	VII	VI	VII	VI
No. of turbogenerators	2-5	4	4	3	3	5	2	3	2	2	2	3	2	2	2	2
Total capability rating[2]	IX	IX	VIII	VIII	VIII	VIII	VIII	VIII	VII	VII	VIII(gr)	VII	VII	VII	VII	VI
Range, capab'y. basis(Mw)[2]	VI-VI	III-IX	VI-VI	II-VIII	II-VIII	IV-VIII	III-VII	III-VIII	VII-VII	I-VII	.....	III-VII	IV-V	II-VII	I-VI	IV-VI
No. of boilers	6	4	4	6	6	5	2	3	2	2	2	3	2	2	2	1
Rating range (M lbs/hr)	1,000-1,000	40-150	950	28-550	28-550	430-550	310-930	...-2925	...-860	100-700ea.	625-1225	52-1475	360-510	110-700	80-670	575-620
Steam pressure, psi	1450	2,000	1500	1405	1405	1250/1500	2000	1250	1250	1650	1550/1350	1250	1450(Thr.)	875	1450	1250 & 1450
Steam temp. Initial Supht (F)	1000	1050	1050	950	950	950/1000	1050	950	950	1000	1000/955	950	1000	900	1000	950, 1000
Reheat (F)	.....	1000	1000	.....	.....	1000	1000	.....	.....	1000	1000/none	.....	1000	none	1000	1000
Cooling water range (F)	43-87	38.5-87	37-82	45-71	54-63	37-86.6	.....	40-93	35-83	33-85	38-95	89-103	40-78	35-90	36-76	61-80
Corresponding vacuum (in. Hg)	28.99-27.82	29.08-27.38	.....	29.5-28.9	28.02-28.49	29.21-27.64	.....	29.18-27.17	29.2-28.0	29.5-28.0	29.12-27.66	27.8-28.6	28.97-27.83	29.5-27.5	29.32-28.22	28.91-28.15
Plant site area (acres)	505	143	155	278	278	228	207	716.35	57	700	900	1100	27	950	80	.....
In use (acres)	334	143	65	78	68	170	207	348.4	57	69	110	50	27	40	80	34
Fuel storage cap., coal (tons)	700,000	1,000,000	150,000	.....	.....	225,000	200,000	400,000	240,000	200,000	100,000	127,000	70,000	130,000	100,000	100,000
Oil (bbl)	.....	2,400	125,000	300,000	480,000	.....	1,200	1714.3	.....	.....	350	.....	1.048	125,000	.....	60,000
Gas (M cu ft)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Employees, total (24 hours)	322(61)	.....	206	107	99	142	.....	134	75	94	61	88	77	89	99	60
Operation	157	.....	105	54	54	62	.....	80	35	59	20	44	40	42	49	33
Maintenance	81	.....	52	34	31	54	.....	17	10	9	15	20	18	32	21	20 (+Fuel)
Clerical stores	14	.....	13	19(tech)	14	9	.....	11	3	2	4	11	4	5	13	5
Fuel handling	60	.....	26	0	0	9	.....	26	8	16	9	11	15	10	11	above
Guards	10	.....	4	0	0	4	.....	.....	0	8	13 (other)	4	.....	.....	4	2
Station Details																
Car dumper, pulverizers	√, √	—, √	—, √	—, —	—, —	√, √	—, √	√ (Shk), √	—, √	—, √	—, √	—, √	√, √	—, √	√, √	—, √
Stokers, controlled circulation	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —
Pressurized-, cyclone furnace	—, —	√, —	—, —	—, —	—, —	—, —	√, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —
Outdoor boiler, outdoor fans	—, —	—, —	Semi, √	√, √	√, √	Semi, H	—, —	—, √	—, —	—, —	√, √	√, √	—, —	—, —	—, —	√, √
Outdoor air heater, spray pond	—, —	—, —	√, —	√, —	√, —	√, —	—, —	—, —	—, —	—, —	√, —	√, —	—, —	—, —	—, —	√, —
Cooling tower, centr. control	—, √	—, √	—, √	—, √	—, √	√, √	—, √	—, √	—, √	—, —	√, √	√, √	—, √	—, √	—, √	√, √
Flyash coll.: M(ech), E(lec)	M, —	M, —	M, E	—, —	—, —	M, —	M, —	M, —	M, E	M, —	M, —	M, —	M, —	—, E	M, —	M, E
Isol. ph. bus, demineralizer	—, —	—, —	—, —	√, —	√, —	√, —	—, —	—, —	—, √	—, —	√, —	—, —	√, —	—, —	√, —	√, —
Fuel Consumption Data																
Coal, (short tons)	1,498,999	1,820,294	818,397	.....	.....	601,515	491,373	248,524	256,025	146,219	327,931	202,190	446,113	296,144	497,136	.....
Btu/lb	11,429	11,150	13,207	.....	.....	13,002	11,800	12,008	11,919	12,100	13,925	11,430	13,516	13,675	13,290	.....
Ash (%), moisture (%)	10.9; 9.4	13.5; 8.5	.....	.....	.....	7.24; 5.94	15.5; 5.5	7.87; 9.26	13.52; 6.04	10.0; 7.0	5.27; 4.20	11.5; 9.5	9.08; 4.18	7.4; 3.7	7.5; 3.95	.....
Cost, ¢/million Btu	20.43	18.97	32.619	.....	.....	27.19	18.65	30.64	18.4	29.50	34.8	18.5	34.3	32.4	30.3	.....
Oil (bbl)	.....	5,640	701,636	549,104	354,029	.....	5,790	844.42	.....	.....	.....	3,346	45,100	481,894	.....	619,163
Btu/gal	.....	137,000	150,463	148,810	148,810	.....	137,000	136,000	.....	.....	.....	153,000	138,000	149,765	.....	150,929
Cost, ¢/million Btu	.....	95.64	31.627	23.63	25.45	.....	76.94	95.25	.....	.....	.....	85.0	79.5	31.2	.....	25.1
Gas (m cu ft)	.....	.....	5,744,511	5,489,756	13,615,213	.....	.....	12,752,190	.....	.....	.....	.....	.....	.....	.....	.....
Btu/cu ft.	.....	.....	1,065	1,061	1,081	.....	.....	1027	.....	.....	.....	.....	.....	.....	.....	.....
Cost, ¢/million Btu	.....	..	26.145	24.71	26.03	.....	.....	22.61	.....	.....	.....	.....	.....	.....	.....	.....
Output Data																
Total gross gen. (millions kwhr)	3,563	4,553	3,274	754.5	1,439.9	1,637	1,316	1783.777	605.2	376	940.03	858.325	0,282	1017.9	1463	353
Total net gen. (millions kwhr)	3,385	4,312	3,073	676.8	1,326.7	1,542	1,251	1705.275	575.1	359	894.32	780.898	1,226	964.4	1393	326
Maximum 1-hr peak (Mw)	591(net)	642	492	361.8	355	316	320.3	345	104.2 Net	218	165 (net)	163	161	159	213	70 Net
Hours operation 1950	8,784	8,784	8,784	8,784	8,784	8,784	8,125	8,784	6,351.1	.....	.....	8,784	.....	8,784	8,036/8,056	8,219.1
Operating Costs (Mills per NET kwhr																
Fuel	2.067	1.796	3.272	3.325	3.312	2.817	1.735	2.81	1.957	2.83	3.55	2.27	3.38	3.732	2.8699	2.998
Wages and superintendence	0.261	0.127	0.258	0.543	0.322	0.206	0.229	0.24	0.255	0.40	0.12	0.30	0.25	0.211	0.3311	0.495
Water, lubrication, supplies	0.048	0.024	0.068	0.127	0.047	0.047	0.057	0.04	0.118	0.09	0.02	0.10	0.04	0.068	0.0409	0.247
Maintenance, repairs																
Buildings and structures	.....	0.005	0.020	0.005	0.006	0.009	0.009	0.01	0.015	0.005	0.0006	0.04	0.005	0.016	0.0030	0.011
Boiler plant	.....	0.076	0.128	0.057	0.066	0.064	0.084	0.03	0.016	0.002	0.0316	0.09	0.054	0.068	0.0310	0.077
Fuel handling	.....	0.046	0.064	.....	0.000	0.039	0.058	0.02	0.033	0.005	0.0160	0.02	0.069	0.050	0.0143	0.014
Prime movers and aux	.....	0.017	0.072	0.024	0.048	0.018	0.031	0.02	0.008	0.002	0.0105	0.03	0.029	0.024	0.0132	0.044
Electrical equipment	.....	0.003	0.010	0.001	0.004	0.007	0.007	0.01	0.006	0.000	0.0083	0.01	0.012	0.017	0.0018	0.007
Supervision, engrg, misc	.....	0.020	0.049	0.008	0.011	0.024	0.052	0.03	0.011	0.048	0.0507	0.02	0.016	0.014	0.0035	0.017
Total maintenance	0.107	0.167	0.343	0.095	0.135	0.161	0.241	0.12	0.096	0.12	0.12	0.21	0.100	0.189	0.0669	0.170
Tot. oper. & mtce. (excl. fuel)	0.416	0.318	0.669	0.765	0.504	0.414	0.527	0.40	0.484	0.61	0.26	0.61	0.39	0.468	0.4389	0.912
Total production (incl. fuel)	2.483	2.114	3.941	4.090	3.816	3.231	2.262	3.21	2.441	3.44	3.81	2.88	3.77	4.20	3.3088	3.910

Continued on page 126

TABLE II—Steam Station Unit Investment Cost, Total Power Cost and Performance (1954)

Station Number	191	192	193 (144)	194	195	196 (146)	197	198	199	200	201	202 (62)	203	204	205	206
Investment Data (Dollars per kw of capability)																
(310) Land	0.08	0.12	3.17	1.35	1.42	0.59	0.22	0.062	0.736	1.10	0.41	0.51	0.41	0.1	2.08	0.86
(311) Structures, improvements	24	19.06	22.50	9.73	15.05	29.60	29.11	16.33	48.316	40.70	16.42	31.43	35.75	32.0	29.40	29.74
(312) Boiler plant equipment	45	44.79	56.80	59.08	61.73	47.80	50.42	38.18	62.143	58.20	44.36	58.70	64.50	52.8	54.10	60.01
(314) Turbogenerator unit	38	29.30	29.10	36.48	43.79	31.60	35.86	37.44	40.618	35.40	32.46	44.40	34.31	29.9	36.76	46.85
(315) Accessory elec. equipt	7	5.97	17.75	9.46	15.68	8.25	8.44	4.68	13.320	7.85	5.34	13.63	11.85	8.3	4.57	11.87
(316) Misc. plant equipt	2	0.92	1.09	2.71	1.88	0.83	1.07	0.850	4.178	1.11	2.18	2.89	1.84	1.5	2.71	0.88
Total station	116	100.16	130.41	119.81	138.95	118.80	125.12	97.54	169.31	145.00	101.17	151.56	148.66	124.6	129.62	150.21
Outdoor switchyard	9	5.83	4.68	14.13	12.73	7.20	6.27	4.21	.....	10.08	6.58	8.22	3.88	8.0	6.81	8.45
Total, station and switchyard	125	105.99	135.09	132.94	151.68	126.00	131.39	101.75	169.31	155.08	107.75	159.78	152.54	132.6	136.43	158.66
Building	19.10	18.21	17.20	7.72	10.84	.....	27.91	15.00	33.195	.....	10.27	.....	26.56	24.3	22.21	16.09
Condensing supply works	5.20	2.43	3.10	3.25	8.65	.....	4.46	3.15	9.618	.....	4.33	.....	6.10	6.6	4.10	10.66
Fuel handling	9.50	5.68	10.60	3.85	6.21	.....	7.24	7.30	12.753	.....	6.87	.....	7.36	7.6	4.43	13.29
Ash handling	2.10	1.02	4.10	.....	.....	.....	1.48	0.86	5.260	.....	0.95	.....	2.97	1.2	0.56	3.43
Draft system	5.10	1.82	3.04	5.97	7.55	.....	.....	4.27	6.590	.....	6.53	.....	8.22	9.8	3.11	3.45
Feedwater system	4.10	3.47	5.26	6.13	5.34	.....	3.63	3.29	5.021	.....	3.66	.....	5.03	5.2	5.16	6.19
Piping system	8.30	7.11	12.55	14.05	12.56	.....	7.77	5.39	3.952	.....	8.89	.....	13.87	7.0	7.47	13.99
Condensers	3.10	2.05	2.59	4.90	6.02	.....	.....	4.37	5.165	.....	4.02	.....	2.70	4.1	2.31	3.11
Switchgear, station wiring	6.60	4.87	16.70	9.46	15.68	.....	6.83	4.02	9.351	.....	4.58	.....	11.81	6.4	4.55	11.03
Cost of Energy (Mills per NET kwhr)																
Fixed charges	1.0	2.21	2.305	10.02	5.831	4.045	4.72	2.34	6.56	.....	2.08	4.78	2.34	2.58	2.7235	1.06
Computed at (%)	6	15	11.5	15	15	15	15	13.2	15	.....	12.5	15	12.5	12.5	14	15
Production charges (Table I)	2.48	2.114	3.941	4.09	3.816	3.231	22.02	3.21	2.441	3.44	3.81	2.88	3.77	4.20	3.3088	3.910
Total	3.48	4.324	6.246	14.11	9.647	7.276	6.98	5.55	9.00	.....	5.89	7.66	6.11	6.78	6.0323	4.97
Station Performance 1952																
Billions Btu used	34,264	11.53	32,177	9,256	16,931	15,750	11,637	19,069.87	6,100	3,538	9,179.5	9,270.3	12,100	11,135	13,214	3,924.9
Fuel cost, ¢/million Btu	20.43	11.82	31.251	24.31	25.96	27.19	18.815	25.15	18.4	29.5	34.8	19.1	34.3	32.1	30.3	25.1
Btu/NET kwhr send out	10,121	9,417	10,470	13,675	12,760	10,211	9,304	11,182.87	10,640	9,495	10,264	11,871	9,775	11,546	9,480	12,047
Btu/GROSS kwhr generated	9,616	8,918	9,828	12,265	11,757	9,624	8,842	10,690.73	10,080	9,066	9,765	10,800	9,368	10,939	9,045	11,100
Aver. boiler efficiency (%)	87.8	89.5	88	87.7	87.35	89.75	90.0	88.5	88.03	89.8	87.5	89	90.4	88	.....	88
Station thermal efficiency, NET (%)	33.7	36.24	32.6	24.95	26.74	33.42	36.68	30.5	32.08	41.2	33.25	29	34.9	29.56	36	28.34
Employees per 1000 Kw per day	0.429(6Un)	.....	0.45	0.296	0.291	0.429	.....	0.388	0.358	0.49	0.36	0.537	0.51	0.65	0.50	0.5
Plant Factor, annual (%)	84.8	87.95	81.9	25.26	48.21	68.76	88.73	58.86	86.8	.....	76.9	59.7	91.2	77.3	79.6	56
Utilization Factor, annual (%)	100.1	107.00	108.0	106.41	104.41	95.47	106.77	100	100.0	.....	101.0	99.2	100.6	106.0	106.5	106
Station Space Factors																
Boiler room (cu ft/kw)	12.7	11.53	6.35	OD	OD	9.2	10.96	0.35	11.62	16.3	OD	OD	14.5	17.4	14.97	.....
Turbine room (cu ft/kw)	7.0	11.82	7.14	8.62	7.236	9.4	11.24	0.16	7.51	9.4	OD	2.611	14.9	10.6	7.08	2.57
Switch house (cu ft/kw)	0.40	.....	.....	0.15	(Incl)	.....	.....	0.005	0.67	0.6	0.09	0.22	2.0	.....	None	.....
Office, employee areas (cu ft/kw)	0.42	1.55	1.32	0.46	0.2380	0.63	1.03	0.04	2.39	2.5	0.21	0.270	0.65	0.54	1.31	1.20
Building, ground area (sq ft/kw)	0.22	0.228	0.18	0.18	0.1759	0.303	0.181	1.70	0.272	0.465	0.16	0.176	0.41	0.4	3.25	1.33
Switchyard (sq ft/kw)	0.24	0.085	0.40	1.62	1.3269	0.233	0.055	0.87	0.024	0.9	0.40	0.20	0.06	0.4	0.24	0.87
Fuel storage area (sq ft/kw)	1.81	1.02	0.46	0.90	1.4918	0.68	0.62	2.08	0.954	1.43	1.18	0.25	1.20	0.9	0.60	1.280
Coal storage (tons/kw)	0.93	1.67	0.33	.....	.....	0.75	0.67	1.15	1.14	1.175	0.59	0.78	0.47	0.9	0.50	667.5

(1) Normal function: (a) Normal system station; (b) Normal distribution station; (c) Normal transmission station; (d) Normal base load; (e) Standby; (f) Power and District Steam.
(2) Rating groups, Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

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TABLE I—Steam Station Equipment Data and Production Costs (1952)—(Continued)

Station Number	207	208	209	210 (123)	211 (155)	212	213	214 (167)	215 (137)	216	217	218	219	220	221	222
General Data																
Normal function[1]	(a)	(a)	(a)	(a)	(a)	(a), (d)	(d)	(a)	(a), (c)	(a), (b), (d)	(a)	(a)	(a)	(a)	(a)	(a)
Year, initial operation	1916	1951	1950	1948	1949	1950	1952	1949	1928	1952	1951	1952	.....	1951	1952	1950
latest unit	1950	1951	1951	1951	1949	1951	1952	Mid 1952	1951	.....	.....	1952	1951	.....	.....	1951
Total gen. rating (nameplate)[2]	VI	VI	VI	VI	VI	VI	V	V	V	V	IV	IV	IV	IV	IV	IV
No. of turbogenerators	8	2	3	3	2	2	1	3	7	1	1	1	1	1	1	2
Range, capab'y. basis (Mw)[3]	VI	VI	VI	VI	VI	VI	VI	VI	V	V	V	IV	IV	IV	IV	IV
Total capability rating[3]	I-II	IV-IV	I-III	II-IV	.....	II-VI	VI	V-VI	I-V	II-V	I-V	I-IV	I-IV	.....	IV-IV	I-II
No. of boilers	22	2	3	3	2	2	1	3	8	1	1	1	1	1	1	2
Rating range (M lb/hr)	30-300	125-600	75-1350	350-625	...-1350	190-1020	825	900-990	72-300	150-820	60-700	50-630	100-600	...-625	500-550	0-300
Steam pressure, psi	220 & 850	1300	850	850/1250	920	850 (900)	1450	850	300-850	1,350	850	935	1,269	1,350	1,650(thr)	850
Steam temp. Initial Supht (F)	100 & 373	950	900	950-955	905	900	1000	900	679-900	955	905	950	960	955	1,000	900
Reheat (F)	.....	.....	.....	None	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,000	.....
Cooling water range (F)	31-80	35-85	65-82	61-102	73-97	54-96	32-78	52-90	32-91	68-86	33-75	32-90	37-57	45-89	33-82	50-70
Corresponding vacuum (in. Hg)	29.5-27.5	29.28-27.70	28.9-27.71	27.80-25.86	27.88-.....	28.89-27.08	29.2-27.6	29.3-27.25	29.3-27.0	28.60-27.73	29.5-27.0	29.4-27.3	29.50-28.86	28.9-27.15	29.6-28.1	.....
Plant site area (acres)	18.7	110.64	65.4	180	401	130	15.03	45	55	20	20	1,422	.....	450	60	.....
In use (acres)	9.2	110.64	25.6	39	401	50	15.03	18	55	20	6	70	200	3.5	.....	.....
Fuel storage cap., coal (tons)	45,000	220,000	100,000	.....	.....	100,000	100,000	0	100,000	.....	.....	250,000	100,000	0	60,000	.....
Oil (bbl)	57,500	80,714	.....	.....	25,000	.....	146,000	0	950	178,999	80,000	140	.....	27,500	.....	140,000
Gas (M cu ft)	.....	.....	.....	.....	.....	.....	.....	0	.....	.....	.....	.....	.....	.....	.....	.....
Employees, total (24 hours)	130	97	67	41	47	33	38	35	91	34	26	35	.....	30	59	.....
Operation	60	35	44	24	26	14	16	20	45	14	23	20	.....	14	24	.....
Maintenance	55	34	19	13	13½	11	14	13	38	9	3	7	.....	10	20	.....
Clerical stores	3	14	2	2	(+Sup.)3½	2	2	1	4	2	.....	2	.....	1	3	.....
Fuel handling	5	8	2	0	0	.....	1	.....	4	.....	.....	6	.....	.....	5	.....
Guards	7	5	0	2	4	6	5(sup., tech.)	.....	.....	6	.....	.....	.....	.....	4	.....
Station Details																
Car dumper, pulverizers	—, √	√, √	—, √	—, —	—, —	—, √	—, √	—, —	—, 7	—, —	—, —	—, √	—, √	—, —	—, √	—, —
Stokers, controlled circulation	√, —	—, —	—, —	—, √	—, —	—, —	—, √	—, —	5, —	—, —	—, —	—, —	—, —	—, —	—, —	—, —
Pressurized-, cyclone furnace	—, —	—, —	—, —	—, √	—, —	—, —	—, —	√, —	—, —	—, —	—, —	—, —	—, √	—, —	—, —	—, —
Outdoor boiler, outdoor fans	—, —	Semi, √	√, √	√, √	√, √	Semi, Semi	√, √	√, —	—, —	√, √	√, √	—, —	—, —	√, √	—, —	Semi, Semi
Outdoor air heater, spray pond	—, —	√, —	√, —	√, —	√, —	√, —	√, —	√, —	—, —	√, —	√, —	—, —	—, —	√, —	—, —	Semi, —
Cooling tower, centr. control	—, —	—, √	√, √	√, √	√, √	√, √	—, √	—, —	—, —	√, √	—, √	—, √	—, —	—, √	—, √	—, —
Flyash coll.: M(ech), E(lec)	—, √	M, —	M, —	—, —	—, —	—, —	M, E	—, —	M, —	—, —	—, —	—, E	—, —	—, —	M, —	—, —
Isol. ph bus, demineralizer	—, —	√, —	√, —	—, —	—, —	—, —	√, √	—, —	—, —	—, —	√, —	√, —	—, √	—, —	√, —	—, —
Fuel Consumption Data																
Coal, (short tons)	119,234	387,762	105,577	.....	.....	622,717	0	.....	235,952	.....	.....	58,339	158,134	.....	186,500	.....
Btu/lb	14,093	13,294	9,932	.....	.....	11,913	12,818	.....	12,530	.....	.....	11,024	12,961	.....	13,300	.....
Ash (%), moisture (%)	6.4; 3.7	8.4; 3.42	5.0; 20.0	.....	.....	7.0; 11.6	7.28; 4.45	.....	9; 5	.....	.....	11.8; 11.7	6.73; 5.71	.....	9; 3.5	.....
Cost, ¢/million Btu	38.3	31.53	23.36	.....	.....	24.189	33.89	.....	31.9	.....	.....	32.26	35.74	.....	33	.....
Oil (bbl)	687,939	19,423	None	.....	165	.....	361,958.8	.....	Ign. Only	4,030	3,000	277	Negl.	.....	.....	708,368.19
Btu/gal	151,581	150,000	.....	.....	147,619	.....	149,688	.....	138,000	142,857	151,000	134,200	.....	.....	.....	6,329,553/bl
Cost, ¢/million Btu	37.34	36.8	.....	.....	22.8	.....	34.56	.....	.....	45.14	19.43	93.45	.....	.....	.....	33.15
Gas (m cu ft)	.....	.....	8,923,568	12,723.91	12,313,714	8,090,317	119,999	6,277,130	.....	3,280,716	10,000	.....	.....	4,508,727	.....	.....
Btu/cu ft	.....	.....	837	1,040.2	1,068	1,213	1,065	1,054	.....	1,076	1,127	.....	.....	1,127	.....	.....
Cost, ¢/million Btu	.....	.....	12.57	10.8	9.4	9.143	28.84	8.22	.....	8.22	13.39	.....	.....	11.53	.....	.....
Output Data																
Total gross gen. (millions kwhr)	543.818	997	827.180	1,156.29	1,126	863	254.6	571.48	425	316.43	320,496	117.6	408.85	463.44	519	397.0
Total net gen. (millions kwhr)	519,371	942	768.601	1,088.65	1,067	814	244	545.94	393	293.09	304,024	112.1	381.54	441.33	487	377.14
Maximum 1-hr peak (Mw)	117.2 (Net)	138.3 (Net)	145	148.5 (Net)	154.1	110	108 (Net)	107.8 (Net)	81	82.2	75	73.2	73.375	71	74	61.3
Hours operation 1950	8,784	8,784	.....	8,729.45	8,784	8,784	2,793	8,775	8,784	6,013.5	7,383	2,049	.....	8,535	8,446	.....
Operating Costs (Mills per NET kwhr)																
Fuel	5.63	3.52	1.88	1.34	1.15	1.107	3.374	0.996	4.80	1.00	2.310	3.714	4.246	1.328	3.37	4.0
Wages and superintendence	0.62	0.23	0.23	0.17	0.13	0.168	0.229	0.180	0.63	0.32	0.365	0.548	0.345	0.155	0.34	.....
Water, lubrication, supplies	0.08	0.06	0.10	0.03	0.01	0.060	0.014	0.054	0.07	0.08	0.045	0.088	0.037	01.05	0.08	.....
Maintenance, repairs				0.10												
Buildings and structures	0.027	0.01	0.0165	0.0021	0.0114	0.018	0.014	0.007	0.06	.....	0.006	0.004	.....	0.013	0.02	.....
Boiler plant	0.258	0.13	0.0339	0.0364	0.0378	0.036	0.057	0.061	0.10	.....	0.100	0.054	.....	0.025	0.18	.....
Fuel handling	0.084	0.01	0.0154		0		0.006		0.10	.....		0.006	.....	.....		.....
Prime movers and aux	0.019	0.05	0.0373	0.0425	0.0251	0.026	0.025	0.030	0.06	.....	0.031	0.003	.....	0.017	0.01	.....
Electrical equipment	0.033	0.01	0.0308	0.0053	0.0201	0.002	0.004	0.003	0.01	.....	0.010	0.018	.....	0.027	0.04	.....
Supervision, engrg, misc	0.015	0.03	0.0128	0.0119	0.0173	0.039	0.029	0.033	0.05	.....	0.025	0.049	.....	0.023	0.04	.....
Total maintenance	0.40	0.27	0.15	0.0119	0.11	0.120	0.135	0.143	0.38	0.22	0.172	0.134	0.117	0.105	0.29	.....
Tot oper & mtce (excl fuel)	1.10	0.57	0.48	0.30	0.25	0.348	0.378	0.377	1.08	0.62	0.582	0.771	0.498	0.365	0.71	.....
Total production (incl. fuel)	6.73	4.08	2.36	1.64	1.40	1.454	3.752	1.373	5.88	1.62	2.892	4.485	4.744	1.693	4.08	4.77

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TABLE II—Steam Station Unit Investment Cost, Total Power Cost and Performance (1952)—(Continued)

Station Number	207	208	209	210 (123)	211 (155)	212	213	214 (167)	215 (137)	216	217	218	219	220	221	222
Investment Data (Dollars per kw of capability)																
(310) Land	4.16	0.7	0.73	0.67	0.72	0.62	0.424	0.973	1.0	3.01	0.562	1.81	.....	2.92	2.4	.....
(311) Structures, improvements	21.51	32.1	23.02	17.52	13.87	28.70	39.124	20.641	25.0	23.42	9.150	69.32	.....	11.92	50.0	.....
(312) Boiler plant equipment	37.48	66.3	76.14	33.60	23.05	58.10	62.914	32.599	49.0	39.07	29.010	74.72	.....	32.30	76.8	.....
(314) Turbogenerator unit	26.80	39.9	48.87	33.61	32.34	49.70	36.791	35.638	46.0	34.60	31.168	42.85	.....	38.25	43.0	.....
(315) Accessory elec. equipt	16.04	13.9	12.71	8.42	7.08	7.70	12.881	6.369	15.0	14.92	4.631	12.13	.....	6.79	12.0	.....
(316) Misc. Plant	4.22	3.1	0.57	0.59	0.57	2.00	0.440	1.915	2.0	1.11	1.163	3.85	.....	1.14	2.2	.....
Total station	110.21	156.0	162.04	94.41	77.63	146.82	152.57	98.135	138.0	116.13	75.684	204.67	117.00	94.32	186.4	.....
Outdoor switchyard	.....	13.2	9.29	6.02	7.77	9.13	4.83	9.003	16.0	6.48	2.557	16.36	.....	6.68	9.2	.....
Total, station and switchyard	110.21	169.2	171.33	100.43	85.40	155.95	157.40	107.143	154.0	122.61	78.241	221.03	.....	101.00	195.6	..
Building	20.33	24.9	17.27	.....	5.26	.....	20.595	.....	.....	9.50	.....	52.27	.....	11.30	38.2	.....
Condensing supply works	.....	9.2	5.53	.....	5.90	.....	3.056	.....	.....	10.53	.....	7.46	.....	10.79	8.6	.....
Fuel handling	.....	11.8	5.24	.....	1.24	.....	11.434	.....	.....	0.42	.....	23.15	.....	2.26	34.6	.....
Ash handling	.....	2.0	1.80	.....	0	.....	2.417	.....	.....	.....	.....	6.64	.....	.....	2.4	.....
Draft system	.....	5.9	7.73	.....	.....	.....	4.338	.....	.....	2.04	.....	3.92	.....	2.72	3.2	.....
Feedwater system	.....	5.6	4.77	.....	3.00	.....	3.890	.....	.....	4.41	.....	4.78	.....	3.64	7.1	.....
Piping system	.....	7.5	10.00	.....	4.22	.....	9.321	.....	.....	7.77	.....	8.37	.....	4.50	14.1	.....
Condensers	.....	4.9	5.42	.....	6.10	.....	4.176	.....	.....	5.30	.....	5.95	.....	4.74	6.0	.....
Switchgear, station wiring	.....	11.5	8.18	.....	6.61	.....	6.865	.....	.....	14.92	.....	12.13	.....	13.48	7.3	.....
Cost of Energy (Mills per NET kwhr)																
Fixed charges	1.40	3.29	3.97	1.98	1.58	2.873	3.307	3.003	5.59	3.26	2.545	5.751	3.41	2.54	3.66	.....
Computed at (%)	14	14.7	13.5	15	15	15	15	15	15	13	15	16	15	15	13.6	.....
Production charges (Table I)	6.73	4.08	2.36	1.64	1.40	1.454	3.752	1.373	5.88	1.62	2.892	4.485	4.74	1.693	4.08	.....
Total	11.13	7.37	6.33	3.62	2.98	4.327	7.059	4.376	11.47	4.88	5.437	10.236	8.15	4.233	7.68	.....
Station Performance 1952																
Billions Btu used	7.682	10,222	9,561.8	13,235	13,152	9,829	2,403.4	6,597.3	5,905	3,555.22	3,737.9	1,287.8	4,093	5,090	4,908	.....
Fuel cost, ¢/million Btu	37.9	32.4	14.93	10.8	9.4	9.166	34.26	8.22	31.9	8.24	18.8	32.34	35.74	11.53	33.5	33.15
Btu/NET kwhr send out	14,850	10,859	12,441	12,158	12,323	12,073	9,850	12,133	15,030	12,130	12,295	11,493	10,745	11,550	9,794	1,885
Btu/GROSS kwhr generated	14,180	10,253	11,560	10,402	11,679	11,390	9,446	11,544	13,900	11,240	11,698	10,952	10,239	11,000	9,200	.....
Aver. boiler efficiency (%)	77/86	88.92	83.5	83.6	83.3	85.3	87.75	82.55	82	86.3	81.9	85.4	90.09	83.6	89	91.9
Station thermal efficiency, NET (%)	23.0	31.45	27.45	28.7	27.6	28.27	34.25	28.13	22.7	28.1	27.7	29.7	31.8	29.6	34.9	.....
Employees per 1000 Kw per day	0.88	0.71	0.47	0.29	0.356	0.298	0.355	0.324	0.96	0.425	0.35	0.56	.....	0.40	0.83	.....
Plant Factor, annual (%)	41.8	78.8	65.4	92.03	92.1	89.3	78.52	61.0	55.2	53.5	46.1	91.8	53.7	68	84.1	.....
Utilization Factor, annual (%)	81.9	101.7	100.69	109.79	116.7	100	100.90	105.69	85.2	102.75	114.0	117.1	99.2	96	105.0	.....
Station Space Factors																
Boiler room (cu ft/kw)	20.69	12.23	12.45	OD	.....	8.36[3]	4.316	.....	16.1	OD	.....	28.8	13.6	.....	16.6	.....
Turbine room (cu ft/kw)	10.63	10.12	5.33	0.059	.....	10.38	OD	7.509	16.3	OD	.....	18.3	9.25	.....	4.4	.....
Switch house (cu ft/kw)	3.53	0.29(2.4kv)	0.68	0.017	.....	0.10	0.092(Ctrl)	.....	.....	.....	.....	.....	.....	.....	0.1	.....
Office, employee areas (cu ft/kw)	0.15	1.42	0.17	0.004	0.52	0.609	0.27	0.29	0.34	0.211	.....	3.5	0.50	.....	1.2	.....
Building, ground area (sq ft/kw)	0.52	0.31	0.29	0.054	0.004	15.13[3]	0.177	0.187	0.64	10.9	.....	0.46	.....	.....	0.27	.....
Switchyard (sq ft/kw)	0.12	0.17(12kv)	0.22	1.57	.....	1.11	0.049	1.059	0.95	0.187	.....	1.04	.....	.....	0.29	.....
Fuel storage area (sq ft/kw)	0.88	2.83	2.14	0	.....	1.88	0.195	.....	2.10	.....	.....	8.0	.....	.....	1.61	.....
Coal storage (tons/kw)	0.27	1.59	0.69	0	.....	0.055	0.341	.....	1.05	.....	.....	4.0	.....	.....	0.85	.....

(1) Normal function: (a) Normal system station; (b) Normal distribution station; (c) Normal transmission station; (d) Normal base load; (e) Standby; (f) Power and District Steam.

(2) Rating groups, Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

(3) Housed portion and firing aisle.

(4) Incl. wells, cooling tower, switchyard and water control house.

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TABLE I—Steam Station Equipment Data and Production Costs (1952)—(Concluded)

Station Number	223	224	225	226	227	228	229	230	231	232	233
General Data											
Normal function	(a)	(a), (d)	(a), (b)	(d)	(a), (d)	(a)	(a)	(f)	(a), (d)	(a)	(a)
Year: Initial operation	1951	1950	1951	11-52	1951	1951	1950	1951	1949	1895	1951
Latest unit	1951	1950	1951			1951	1951		1951	1950	
Total gen. rating (nameplate)	III	III	III	III	II	II	II	II	II	II	I
No. of turbogenerators	1	2	1	1	1	1	2	2	3	5	1
Total capability rating	III	III	III	III	II	II	II	II	II	II	I
Range, capability basis (Mw)	II-III	I-III	II-III	I-III	II Gr.	I-II	I-II	II-II	I-II	I-II	I-I
No. of boilers	1	2	2	1	1	1	2	2	3	5	1
Rating range (M lb hr)	250–450	100–210	225	—825	350	120–320	310–132	150–230	57–194	0–315	160
Steam pressure, psi	1250	850	850	875	850	875	600	900	600	300/400	650
Steam temp, initial Suplt (F	950	900	900	900	900	910	900	870	825	550/825	825
Reheat (F)		900									
Cooling water range (F)	60–90	49–69	46–80	49–73	52–94	66–90	33–80	65–90	33–80	55	33–72
Corresponding vacuum (in. Hg)	23.1–27.2	29–23.9	29–28	28.93–24.59		29.11–26.10	29.6–28.2	29–26		29	29.08–27.96
Plant site area (acres)	109		10	1015.46	132.6	31.24	43	25½		0.9	
In use (acres)			5	193	15	18.5	15	15		0.9	
Fuel storage cap., coal (tons)	7	50,000					50,000	50,000		4,000	
Oil (bbl)	55,612		16,500	225,000	55,000	30,000	250	70,000	3,500		
Gas (M cu ft)											
Employees, total (24 hours)	11	34	31	46	35	29	17	37	29	57	23
Operation	27	16	17	37	19	10	12	24	19	16	14
Maintenance	11	6	6	8	12	9	1	5	5	4	5
Clerical stores	1	3	3	1	4	1	1	3	2	35	1
Fuel handling	0	3					2	3	3	2	3
Guards	0	0	2								
Station Details											
Car dumper, pulverizers	—	√					√	√			
Stokers, controlled circulation	—	—					—	—	√	√	√
Pressurized, cyclone furnace	—	—				√	—	—	—	—	—
Outdoor boiler, outdoor fans	—	Semi, √	√, √	√	√, √	√	—	√, √	—	—	—
Outdoor air heater, spray pond	—	√, —	√, √	—	√, —	√, √	—	√, √	—	√	—
Cooling tower, contr. control	—	√, √	—	—	—	√, √	—	√, √	√	√	—
Flyash coll.: M(ech), E(lec)	√	M, —	—	—	—	—	√	M, —	M, √	E, √	M, —
Isol. ph bus, demineralizer	—	—	—	—	—	√, —	—	—	—	√	—
Fuel Consumption Data											
Coal, (short tons)	171,903						16,000	13,394	132,304	7,547.41	34,708
Btu lb	11,400						11,800	11,130	6,989	12,500	12,076
Ash (%), moisture (%)	15.6; 7.0						7.5; 9	8.66; 13.86	6; 34	8.84; 5.7	7.55
Cost, ¢ million Btu	17 65						35	24.8	30 1	31	32 6
Oil (bbl)	1,000			33,939	410,318	71	400	73,800			
Btu gal	138,500			152,000	159,286	142,593	140,000	152,627			
Cost, ¢ million Btu	97.2			35 26	35 6	50 67	83	32			
Gas (M cu ft)			2,169,000			2,116,935	1,450,000	2,521,336		606,924	
Btu cu ft			1,115			1,002	1,000	1,021		1,000	
Cost, ¢ million Btu			12 1			14 19	24	13 2		25 2	
Output Data											
Total gross gen. (millions kwhr)	333 2	344	199 8	18 331	223 03	188 45	143 1	94,720	131	52 8	65 00
Total net gen. (millions kwhr)	318 0	324	190 4	17 262	212 39	177 66	136 6	83,014	123	50 2	61 13
Maximum 1-hr peak (Mw)	48 (Gr.)	45 1 (Net)	48	52 5	37 (Gr.)	33	27 2	27 2	26	11	16 1
Hours operation 1950			8,784	626 3	8,239 1	8,599		7,665	8,784	8,784	7,971
Operating Costs (Mills per NET kwhr)											
Fuel	3 388	2 162	1 59	4 432	4 35	1 69	3 6	2 476	4 61	4 1	4 79
Wages and superintendence	0 393	0 509	0 41	1 145	0 52	0 46	0 32	0 943	0 63		1 21
Water, lubrication, supplies	0 038	0 019	0 08	0 437	0 07	0 17	0 05	0 186	0 099		0 16
Maintenance, repairs											
Buildings and structures	0 013	0 014	0 005	0 002	0 03	0 04	0 029	0 1593	0 0081		0 10
Boiler plant	0 112	0 023	0 06	0 076	0 14	0 06	0 075	0 3447	0 0721		0 16
Fuel handling	0 002	0 064		0 120			0 014	0 0261	0 0186		0 03
Prime movers and aux	0 051	0 015	0 13	0 102	0 07	0 03	0 040	0 1263	0 1022		0 26
Electrical equipment	0 012	0 007	0 005	0 012	0 01	0 02	0 045	0 0650	0 0040		0 03
Supervision, engrg, misc	0 032	0 047	0 04	0 357	0 07	0 09	0 029	0 0757	0 0135		0 10
Total maintenance	0 222	0 170	0 24	0 669	0 32	0 24	0 23	0 738	0 232		0 68
Tot oper, mtce (excl fuel)	0 653	0 614	0 73	2 251	0 91	0 87	0 6	1 867	0 97	1 4	2 05
Total production (incl. fuel)	4 041	2 776	2 32	6 683	5 26	2 56	4 2	4 343	5 58	5 5	6 84

(*Continued from page* 23)

necessarily be confirmed in a thorough study of fuel costs in contrast with carrying charges on investment to effect a saving in any specific plant.

Unfortunately some of these indexes are disturbed by economies obtained by resorting to "outdoor" construction. It will be seen that that tendency is manifested here as elsewhere, by plants in the very areas where fuel is cheapest.

Oil-burning plants cost a bit less than those that burn coal and the difference is largely attributable to the escape from providing for coal storage, handling and pulverizing as well as avoidance of ash. However the coal plants do cost less as the megawatt capacity increases. The paring in unit cost is a fair $55 per kilowatt in going from 40 Mw to 500 Mw or more. Gas burning plants are well below all these values but the sharply lower costs are, as already stated, as much attributable to favorable climate (conducive to outdoor design) as to cheap fuel.

Equipment Accounts . . . Investment in steam generating facilities and accessories (Account 312) is remarkably consistent. In fact the same might be said of the turbogenerator (Account 314). Each falls within comparatively narrow limits if expressed as a per-

TABLE II—Steam Station Unit Investment Cost, Total Power Cost and Performance (1952)—(Concluded)

Station Number	223	224	225	226	227	228	229	230	231	232	233
Investment Data (Dollars per kw of capability)											
(310) Land	0.47	6.51	0.91	3.31	0.42	0.47	.....	0.58	0.14	1.85	.....
(311) Structures, improvements	40.30	29.63	22.30	37.45	28.20	44.77	.....	28.72	37.98	35.0	47.5
(312) Boiler plant equipment	49.20	64.64	21.80	55.75	48.50	37.62	.....	66.18	58.79	52	54.19
(314) Turbogenerator unit	43.20	44.04	34.10	49.10	41.74	41.12	.....	41.59	52.88	57	47.02
(315) Accessory elec. equipt	11.65	9.97	12.50	11.48	13.70	10.44	.....	9.64	10.73	.....	11.13
(316) Misc. plant equipt	1.06	5.11	.....	3.14	3.44	4.39	.....	1.15	0.75	.3	4.15
Total station equipt	147.00	159.89	101.61	160.20	136.00	138.81	152.50	150.86	161.29	149	164.06
Outdoor switchyard	9.00	.....	Incl	12.81	11.22	12.85	12	.....	14.17	.....	14.58
Total station and switchyard	156.00	.....	101.61	173.01	147.22	151.66	164.50	.....	175.46	.....	178.58
Building	33.10	.....	.....	29.20	10.41	.....	.....	.....	.....	.....	47.31
Condensing supply works	9.02	.....	.....	12.95	7.16	.....	.....	.....	.....	.....	1.18
Fuel handling	4.03	.....	.....	14.60	9.49	.....	.....	.....	.....	.....	5.01
Ash handling	.....	.....	.....	0	.....	.....	.....	.....	.....	.....	2.39
Draft system	7.98	.....	.....	5.42	4.15	.....	.....	.....	.....	.....	3.24
Feedwater system	6.12	.....	.....	3.54	5.05	.....	.....	.....	.....	.....	5.52
Piping system	12.54	.....	.....	9.60	11.36	.....	.....	.....	.....	.....	10.20
Condensers	4.43	.....	.....	5.52	9.10	.....	.....	.....	.....	.....	7.41
Switchgear, station wiring	7.02	.....	.....	10.01	10.99	.....	.....	.....	.....	.....	11.13
Cost of Energy (Mills per NET kwhr)											
Fixed charges	3.654	3.250	2.50	6.73	3.95	2.67	5.4	6.00	1.68	3.06	5.39
Computed at (%)	15.5	15	10.6	13.2	15	9.5	16	12.00	4.52	6.4	10
Production charges (Table I)	4.041	2.776	2.32	6.68	5.26	2.56	4.2	4.34	5.58	5.54	6.84
Total	7.695	6.026	4.82	13.41	9.21	5.23	9.6	10.34	7.26	8.60	12.23
Station Performance 1952											
Billions Btu used	3,497.95	3.94	1,900	216.99	2,590.008	2.122	1.81	1.211	1,849.23	794.8	970
Fuel cost, ¢/million Btu	30.798	17.65	12.1	35.26	35.6	14.19	26.9	16.98	30.1	26.53	32.6
Btu/NET kwhr send out	11,000	12,126	13,086	12,570	12,200	11,943	13,271	14,588	15,034	15,57	14,701
Btu/GROSS kwhr generated	10,562	11,460	12,460	11,837	11,610	11,260	12,660	12,780	14,116	14,82	13,769
Aver. boiler efficiency (%)	87.3	86.1	84	88.8	90	85.6	82.9	80.2	78	80	.....
Station thermal efficiency, NET (%)	32.51	28.09	26.2	27	28	28.57	25.7	23.4	22.7	23	.....
Employees per 1000 Kw per day	0.86	0.77	0.7	1.05	0.92	0.61	0.7	.....	0.895	2.75	.....
Plant Factor, annual (%)	79.03	89	49.26	66.52	65	65	57	.....	57.5	29	.....
Utilization Factor, annual (%)	100.0	102.5	104.5	107	97	115	109	.....	100.0	52	.....
Station Space Factors											
Boiler room (cu ft/kw)	19.25	12.43	10 sq ft	0.28	OD	3.326	15.5	8.673	464	.....	24.7
Turbine room (cu ft/kw)	10.08	7.18	10	0.18	OD	13.060	8.0	8.86	.....	.....	16.5
Switch house (cu ft/kw)	.....	0.085	0.1	0.02	0.4	0.777	Incl.	0.863	.....	.....	.....
Office, employee areas (cu ft/kw)	0.865	1.46	0.035	0.09	0.1	1.739	0.8	0.975	0.22	.....	0.62
Building, ground area (sq ft/kw)	0.56	0.36	.....	2.65	0.2	0.525	0.5	2.94	0.65	.....	0.62
Switchyard (sq ft/kw)	2.66	0.176	.....	2.70	1.1	0.873	0.6	0.364	0.54	.....	0.51
Fuel storage area (sq ft/kw)	0.254	.....	0.013	7.19	1.7	0.238	3.0	3.13	1.54	.....	.....
Coal storage (tons/kw)	.....	1.0	.....	.....	.....	.....	2.0	0.91	0.58	.....	.....

(1) Normal function: (a) Normal system station; (b) Normal distribution station; (c) Normal transmission station; (d) Normal base load; (e) Standby; (f) Power and District Steam.

(2) Rating groups, Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VII, 300–499; IX, 500 up.

(3) Incl. bunkers and basement auxiliaries.

centage of total station cost. Recognizing, however, that overall costs of stations in any megawatt bracket vary widely—sometimes two to one—it is plain that the same spread holds for boilers and turbines namely, a two-to-one range. Why this should be is not evident on the surface.

It should be warned that the data plotted are arranged to show smooth transition from high to low values in each segment of the plant facilities. In other words, the boiler cost and turbogenerator cost in any vertical line are not necessarily the ones found in the tables against the correspondingly plotted overall cost. Were this not done the diagrams would look quite erratic and trends would hardly be distinguishable.

It will be noticed here that some of the outdoor and semi-outdoor plants cost as much or even more than the conventionally housed plants. This is particularly apparent in the 100-149 Mw and 300-499 Mw brackets, both among themselves and in comparison with other brackets. Local factors rather than fuel accessories must be looked into for the reasons. Coal burning plants generally are near the top in cost in each size bracket and this circumstance is clearly related to the provision for handling, storage, pulverization, flyash control and ash removal.

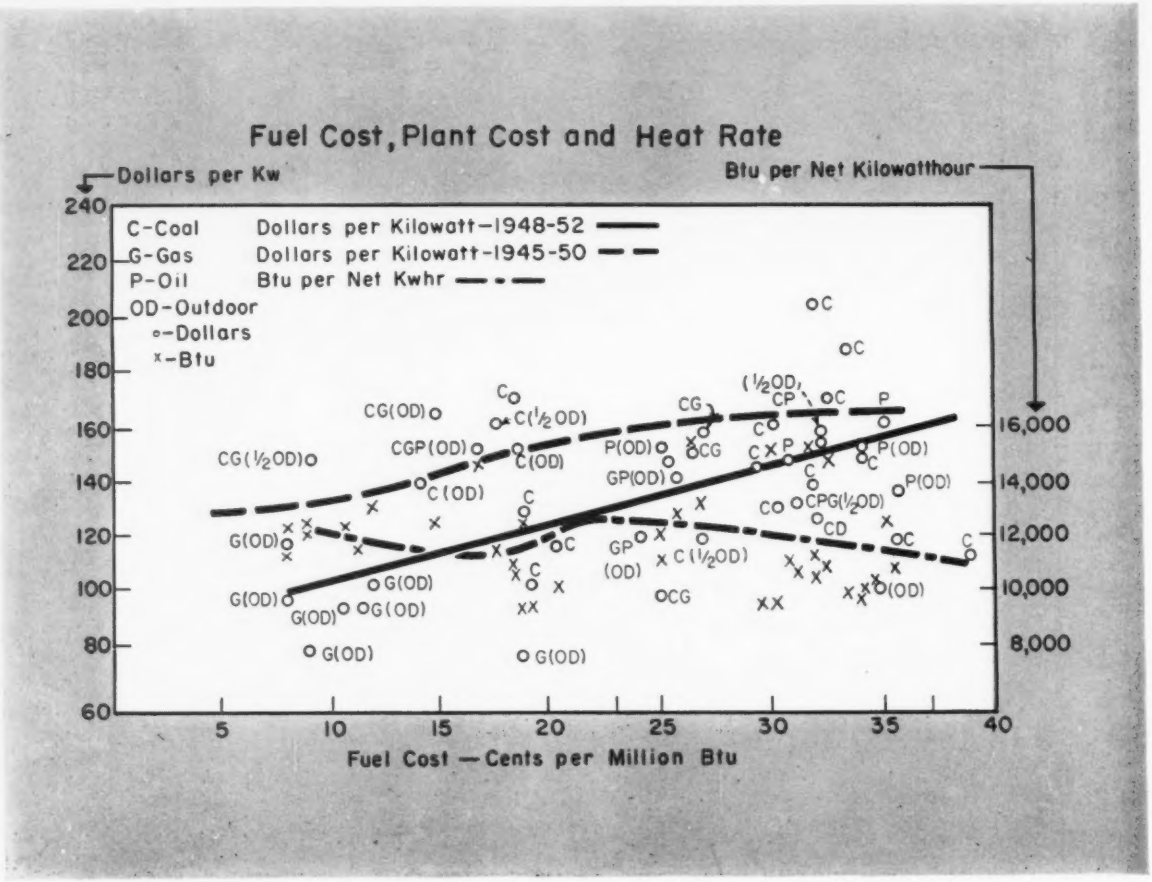


FIG 3—Coal-burning plants trendwise range from $105 to $165 per kw of capability; oil-burning plants $145 to $150; gas-burning plants from $140 down to $90

Steady Improvement in Efficiency

Progress in design further decreases fuel consumption. Steam conditions move to upper brackets. More dependable equipment reduces maintenance outlays

Generating plants entail so much capital that it is imperative to design for minimum outlay compatible with efficient and economic use of fuel whatever its cost. That fuel cost largely dictates the number of dollars devoted to refined operation is evident from the accompanying chart. Least is spent on the plants that burn relatively inexpensive gas and most on the plants burning coal or oil. Fuel costs for the 43 plants analyzed ranged from just over 8 cents per million Btu for gas to nearly 39 cents for coal. The extreme dollars per kilowatt were $75 to $205 but the trend line indicates a spread from $90 to $165. In other words a 5 to 1 increase in fuel cost is accompanied by a 11 to 6 increase in outlay to achieve a

Table II—Plant Maintenance Under ¼ Mill per Net Kwhr.

Megawatt Range	0-19	20-39			40-59		
Maintenance Item	Aver.	Min.	Max.	Aver	Min.	Max.	Aver.
Buildings and Structures	0.10	0.00	0.16	0.04	0.00	0.01	0.01
Boiler Plant	0.16	0.36	0.34	0.13	0.02	0.11	0.07
Fuel Handling	0.03	0.00	0.12	0.03	0.00	0.06	0.02
Prime Movers and Aux	0.26	0.03	0.13	0.08	0.01	0.13	0.06
Electrical Equipment	0.03	0.00	0.04	0.0	0.01	0.02	0.01
Supervision, Engrg, Misc	0.10	0.01	0.36	0.110	0.03	0.05	0.04
Total Maintenance	0.68	0.23	0.74	0.40	0.13	0.72	0.17

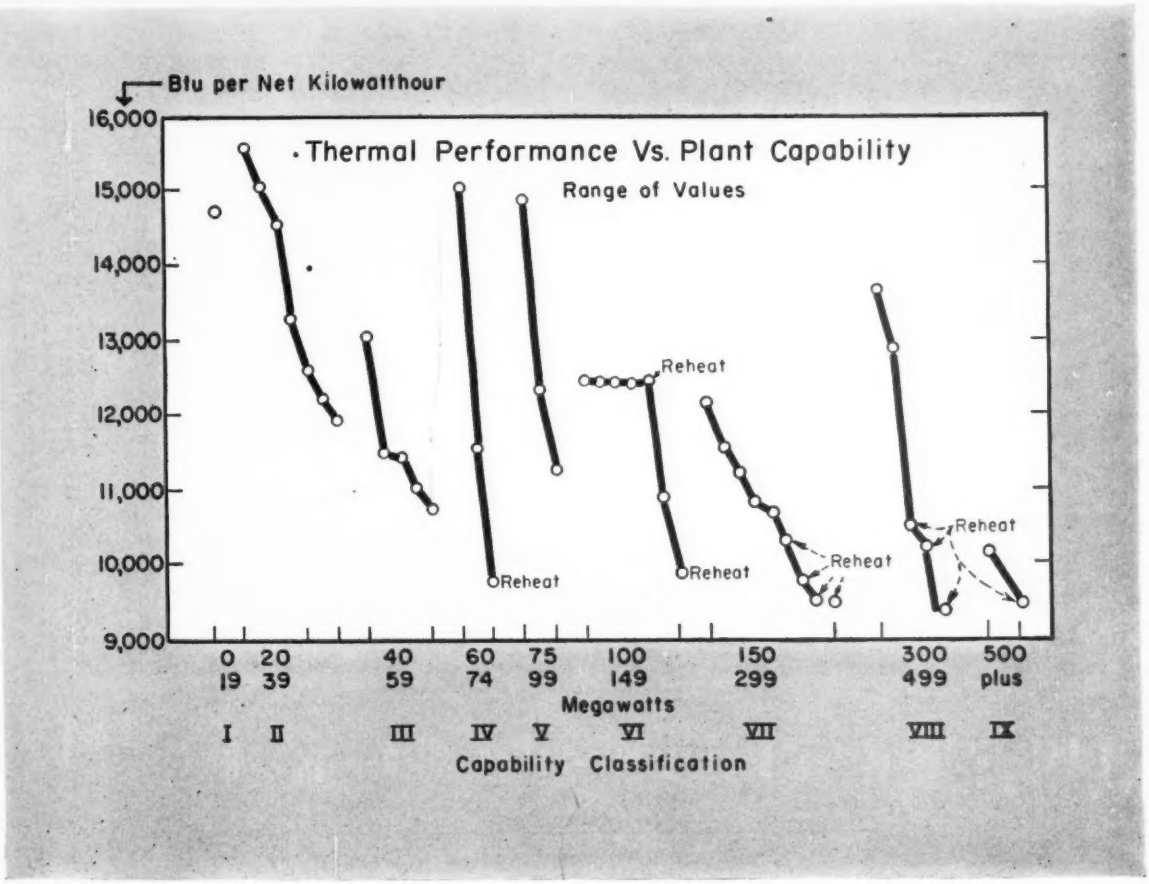


FIG. 4—Best thermal results are obtained by reheat and the reheat practice is still confined primarily to the larger units and plants

better utilization of the more expensive fuel.

Thermal Performance . . . Marked spread typifies the Btu results obtained in the new plants. The range is as great as 35% from high to low. Some of this is attributable to peaking operation on dominantly hydro systems and some to the availability of inexpensive fuel. Significant again here is the fact that the reheat plants excel in thermal performance in the entire compilation. In fact the results here charted show in general much more than the 5 or 6% differential attributed to the technique.

As might be expected the higher steam pressures (and temperatures) give the better heat rates. This betterment is, equally naturally, accentuated by resort to reheat. Transition to these higher pressures has become so pronounced that 80% of the new megawatts operate at 1,200 psi or above.

Operating Activity . . . Plant factors in 1952 were some 10% lower (at about 70%) than was found for new plants in 1950. The year was not phenomenally good as to hydro and this cannot then account for the dip in plant factor. Lowering of the utilization factor curve, on the other hand, is readily understandable. Peak

Boiler maintenance twice as high as for prime movers and auxiliaries

60-74			75-99			100-149			150-299			300-499			500+	ALL		
Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Aver.	Min.	Max.	Ave.
0.00	0.02	0.01	0.01	0.06	0.02	0.00	0.03	0.02	0.00	0.04	0.01	0.01	0.02	0.01	0.01	0.00	0.16	0.03
0.02	0.18	0.08	0.10	0.10	0.10	0.04	0.26	0.12	0.00	0.07	0.04	0.06	0.13	0.08	0.08	0.00	0.34	0.08
0.00	0.01	0.00	0.00	0.10	0.05	0.00	0.08	0.02	0.01	0.07	0.30	0.00	0.06	0.04	0.05	0.00	0.12	0.03
0.00	0.06	0.03	0.02	0.06	0.04	0.02	0.05	0.04	0.00	0.03	0.02	0.02	0.07	0.04	0.02	0.00	0.26	0.06
0.01	0.04	0.03	0.01	0.03	0.02	0.00	0.03	0.02	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.00	0.04	0.02
0.02	0.05	0.04	0.02	0.05	0.03	0.01	0.04	0.02	0.00	0.06	0.02	0.01	0.05	0.03	0.02	0.01	0.36	0.04
0.10	0.19	0.17	0.17	0.38	0.26	0.10	0.40	0.20	0.07	0.21	0.13	0.10	0.34	0.18	0.17	0.10	0.74	0.26

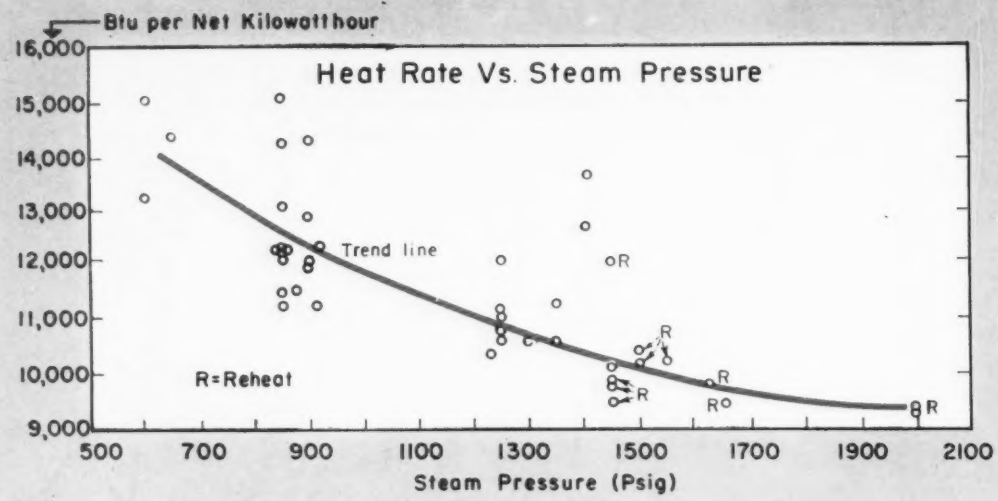


FIG. 5 Higher-steam pressures in conjunction with correspondingly high superheat temperatures give best thermal performance. Reheat accentuates the gains and is becoming universal at the higher pressures

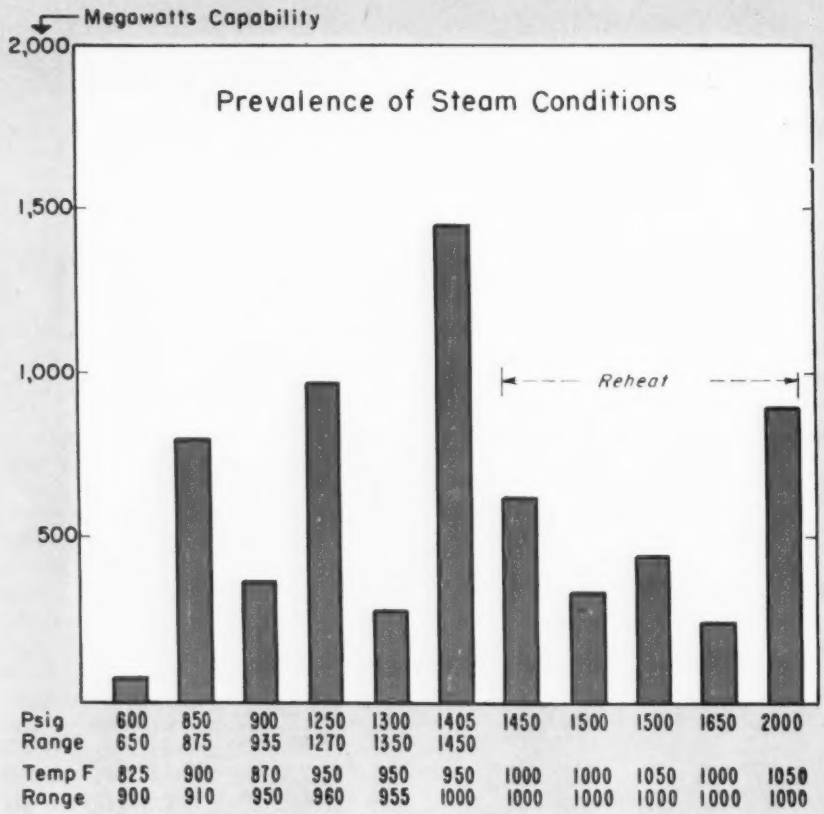


FIG. 6 Favored pressures in 2 years have risen so that 80% of capacity is at 1200 psi or more and only 20% under 1000 psi

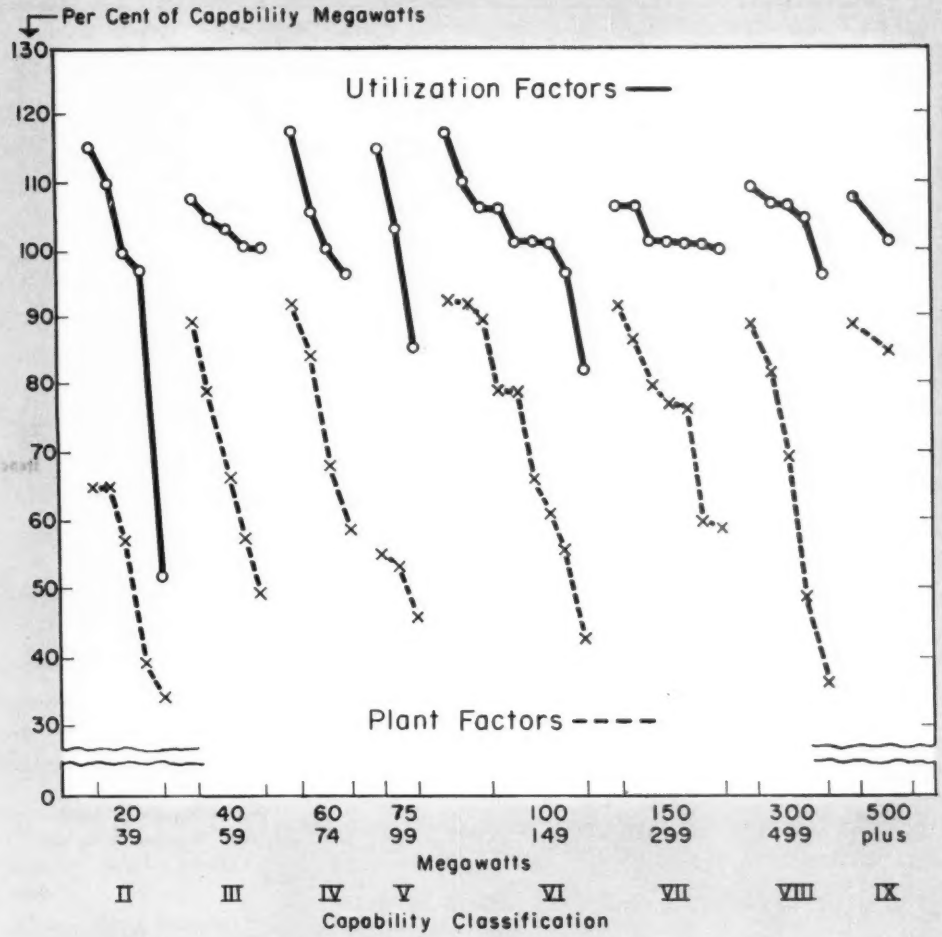
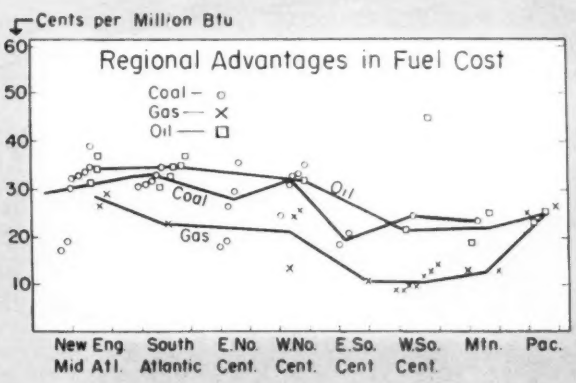


FIG. 7 Equipment is being used advantageously to utilize margins available even above new capability ratings. Plant factors somewhat lower than in 1950

FIG. 8 Oil generally more expensive than coal except in extreme west. Natural gas has the edge everywhere available, particularly the Southern tier of states



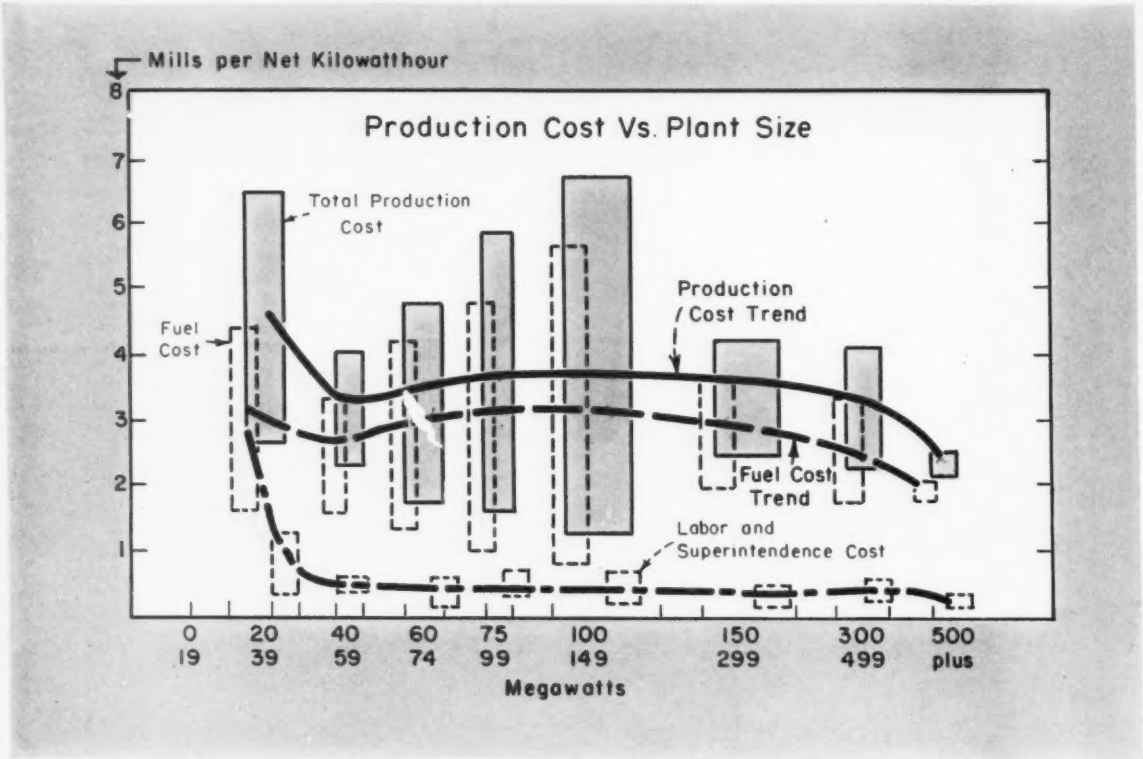
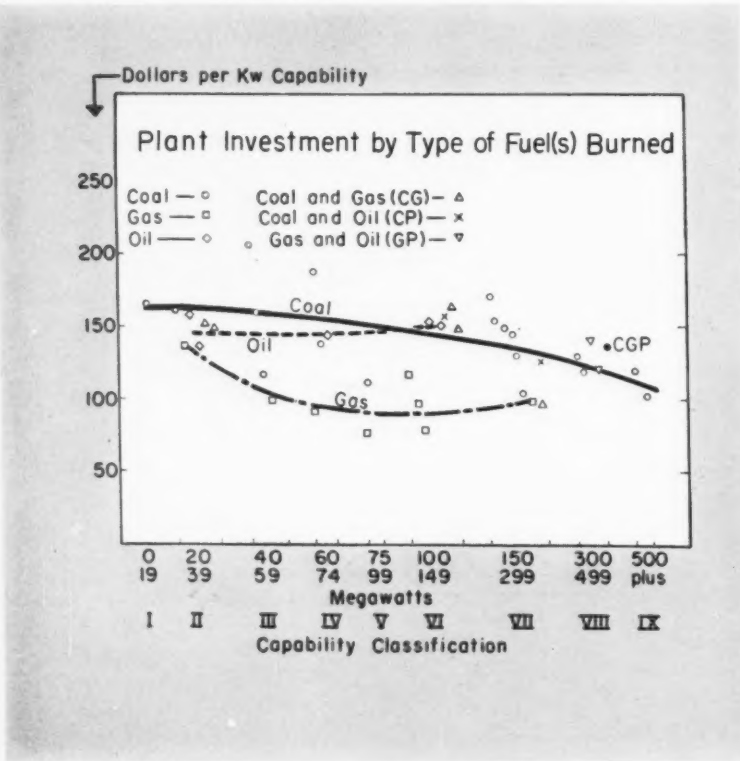


FIG. 9—Fuel constitutes on the average 80% of the total production cost; operating and maintenance labor and superintendence only 11%

FIG. 10—More is invested in plant facilities to obtain better thermal efficiency in areas where fuel costs are relatively high



loadings of up to 145% on a rated megawatt basis are no longer possible on a capability basis; in fact the "velvet" margins have shrunk to a 115% top and a 105% average.

Production Costs . . . Production cost is just above 3½ mills average for plants 60 to 300 Mw capability but dips sharply to 2½ mills for the largest plants. Fuel constitutes a greater share (80%) than ever. Thermal improvements have held down this high component of production cost. Plant labor and superintendence cost now are close to 10% of the total production cost. Centralized control, automatization and instrumentation are factors that have reduced this component. More dependable and durable equipment has held the maintenance charges to about the same low ¼-mill per kwhr that prevailed in 1950. Looming largest among the maintenance accounts is that for the boiler (312) and its auxiliaries. It is nearly one-third the total. Next in order comes the turbine and its auxiliaries (314) at one-fourth the total. The generator, switchgear and electrical equipment call for least maintenance outlay.

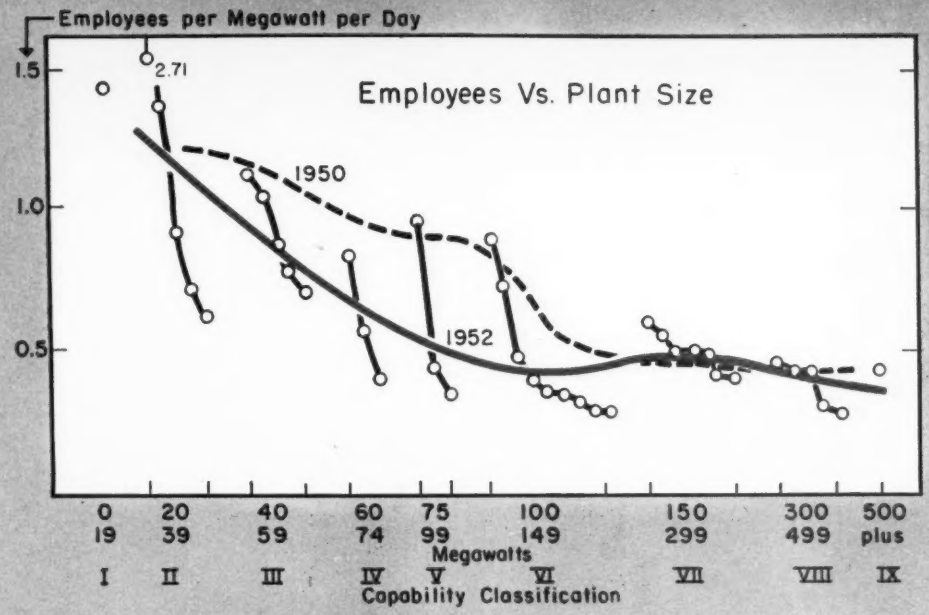


FIG. 11 Plant operating and maintenance forces constitute one man for each 2.2 Mw of capability in plants above 100 Mw and one for 1.25 Mw in smaller plants. Gain has been largely in 40-150 Mw range

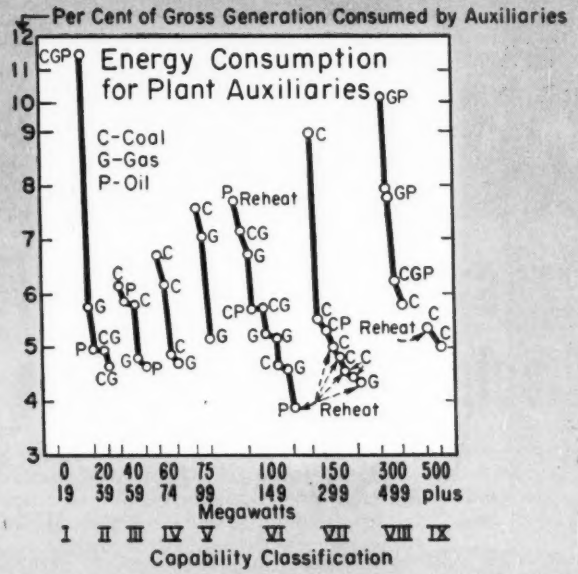


FIG. 12 Power input to auxiliaries varies widely and is not outstandingly related to the fuel burned but is low in amount at reheat plants

Manpower and Auxiliaries Make Gains

Kilowatts per plant employee increased substantially in medium-sized plants. Auxiliary consumption advantageously low for reheat plants

Plant operating and maintenance employees have been reduced in a few plants to as low as 1/3-man per megawatt; the average for plants above 60 Mw is just under ½-man. For the plants from 40 to 150 Mw this means a sizeable betterment from 1950 performance for this bracket where plant forces ran up to 1 man per Mw.

Auxiliary Energy . . . Consumption of part of the gross generation for operation of the auxiliaries varies widely even within each plant-size bracket, thus 4% to over 7½% in the 100-149 Mw group. For the larger (300-499 Mw) plants it stretches from

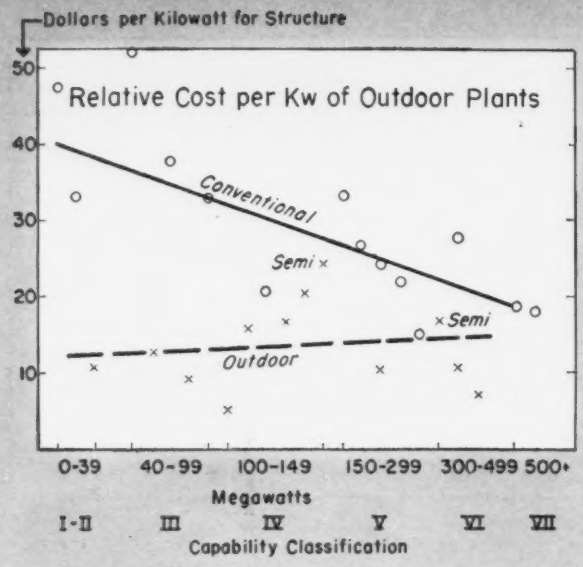


FIG. 13 Outdoor boiler (and occasionally turbogenerator) conserves from $5 to $25 per kilowatt

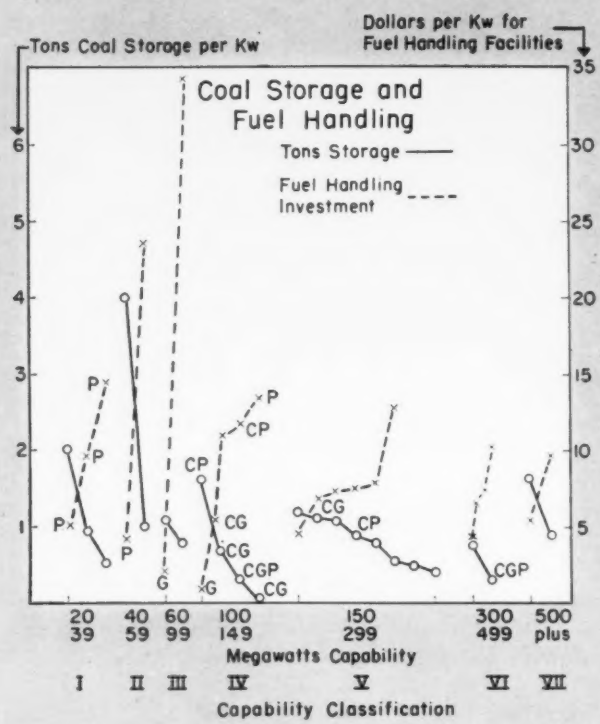


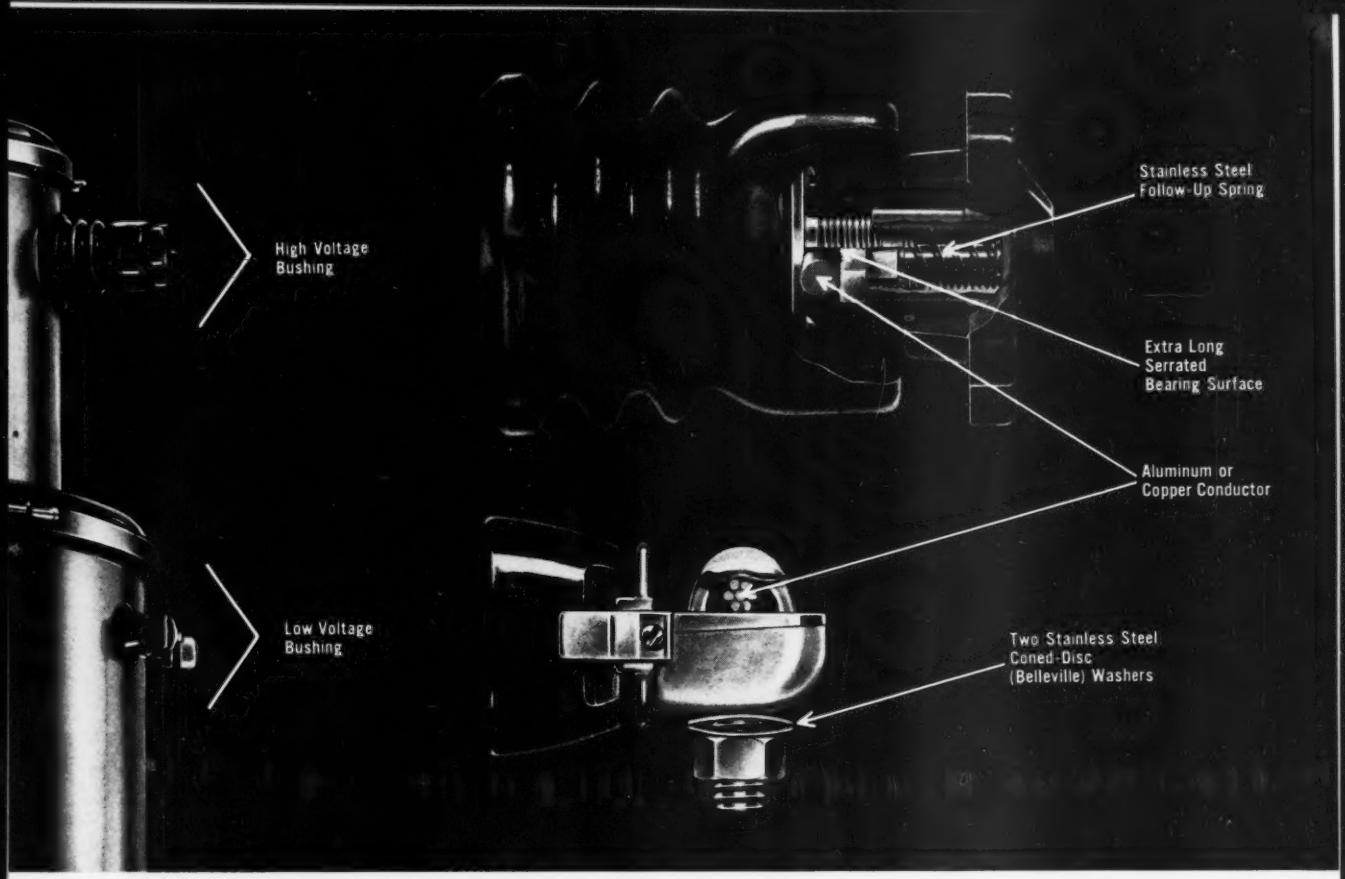
FIG. 14 Coal stored for emergency averages one ton per kilowatt. Investment in fuel handling facilities averages $8.13 per kw. All are coal-plants unless otherwise indicated

nearly 6 to well over 10½%. Nor are the coal burning plants invariably the ones to show greatest auxiliary consumption. One thing can, however, be said with positiveness and that is that the reheat plants quite consistently show the lowest values.

Fuel Stored . . . Only coal is stored in any quantity for insurance against interrupted supply. In the past it has held fairly closely to 1 ton per kw of capability. Now there are comparatively few plants that carry that much storage. Actual tendency is to keep about ¾-ton on hand. Unexplained is the practice of keeping larger amounts on hand at plants where other fuels are used in conjunction with coal.

Investment in fuel handling facilities varies as much as 2½ to 1 but with occasional exceptions the outlay is seldom above $3 per kw, more commonly around a $1.50 average per kilowatt.

Piping Cost . . . Another item that seems to vary widely. For 15 non-reheat plants it has a spread from $3.95 per kw of capability to $14.10 with an average of $9.22 per kw. On the other hand the spread for 10 reheat plants is from $5.39 to $13.99 and in this case the average is $9.41. For the 1952 operations it seems therefore to make little difference in maximum, minimum and average piping cost whether the plant is a reheat plant or not.

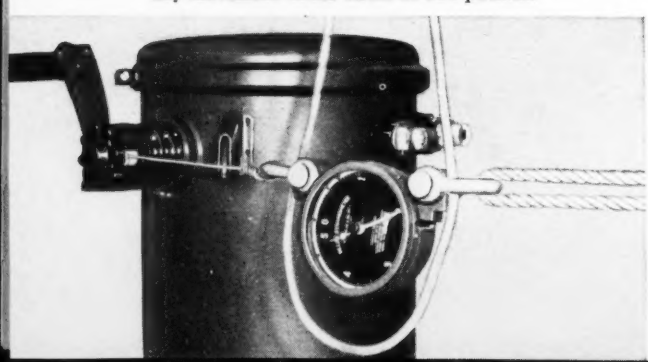

High Voltage Bushing
Low Voltage Bushing
Stainless Steel Follow-Up Spring
Extra Long Serrated Bearing Surface
Aluminum or Copper Conductor
Two Stainless Steel Coned-Disc (Belleville) Washers

G.E. ANNOUNCES new transformer connectors for either copper or aluminum conductor

General Electric has redesigned the connectors of both high- and low-voltage bushings on all pole-type distribution transformers. The new connectors engage either copper or aluminum conductor without requiring special fittings. The connectors prevent loosening of connections by "cold-flow" and temperature changes.

High-voltage tank-wall bushings have a stainless-steel follow-up spring inside the porcelain and an extra-large serrated bearing surface, which securely grips the wire and breaks down the aluminum oxide. The spring maintains pressure on the conductor, even when cold-flow occurs (see test photo below). In connecting a transformer, the spin-free knob on the bushing is tightened in the usual manner.

Test on new G-E connector with follow-up spring. With bushing connector relaxed to simulate a 10% creep in No. 6 aluminum conductor, clamp holds wire without any movement under stress of 200 pounds.



Low-voltage and high-voltage cover bushings have two stainless-steel, coned-disc spring (Belleville) washers. These washers maintain pressure on the conductor in the same manner as in the high-voltage tank-wall bushings.

These design changes answer the problem of "cold-flow." In addition, all copper-alloy parts are tin-plated to prevent galvanic action of the connectors when in contact with aluminum. In areas where salt or chemical fumes are unusually severe, however, transitive adapters should be used with aluminum conductors.

These new bushing connectors will be supplied as standard on all G-E pole-type distribution transformers. EEI-NEMA recommended terminal openings will be maintained.

For more information on these new connectors, contact your nearest G-E Sales Representative, or write General Electric Company, Section 431-11, Schenectady 5, N. Y.

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

You can put your confidence in—

GENERAL ELECTRIC

DISTRIBUTION TRANSFORMERS

different from others because....

....Magne-valve arrester

(gapped valve-type) can be used any place on your system...regardless of short-circuit currents

Small in size and light in weight, the new General Electric Magne-valve arrester has impulse characteristics similar to those of G.E.'s modern pellet arrester—the quality standard of performance in the electrical industry. The new arrester—gapped to the bushing in the same manner as modern pellet arresters on unit-type 2400- and 4800-volt transformers—is now standard on all G-E EEI-NEMA 7200- and 7620-volt unit-type transformers.

NEW ARRESTER FEATURES:

Valve action—Thyrite* valve action is augmented by magnetic action of an internal series gap.

External gap—No 60-cycle voltage across arrester under normal operating conditions—no chance for grounding circuit if arrester is damaged.

Elimination of unnecessary breaker tripping—Unlike expulsion-type arresters, there is no short circuit during discharge and no erosion to limit the useful life of the arrester.

Small size and light weight—9-kv arrester, for 7200-volt transformer, is only 14¼" long, weighs only 10 pounds.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

For more information contact your nearest G-E sales office or agent, or write General Electric Company, Section 431-9, Schenectady 5, New York.

Reg. trade-mark of General Electric Company

You can put your confidence in—

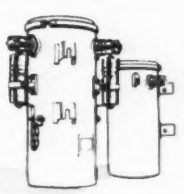
GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	NO

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

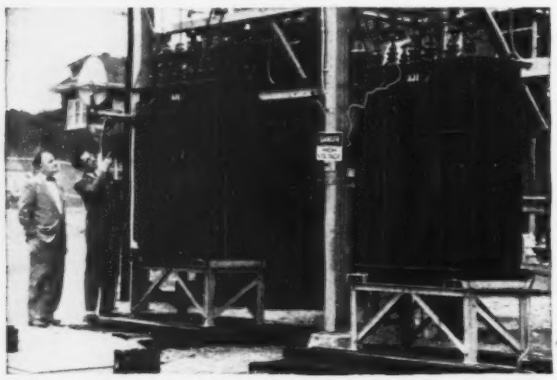


UNIT-TYPE CONVENTIONAL

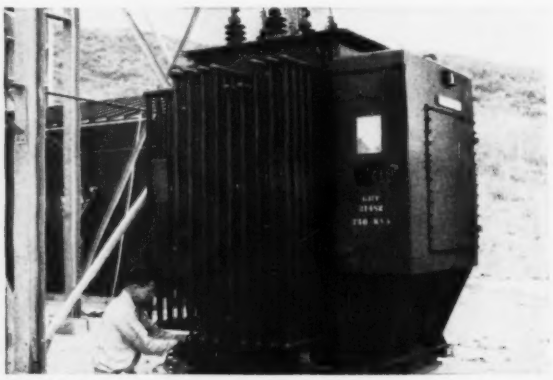
"Take your choice G.E. makes both"

IRS single-phase induction regulators supply the finest regulation obtainable for heavily loaded feeders where voltage variations are frequent and immediate response essential. Their sealed tank construction prolongs oil life.

ML32 step regulators provide low-cost dependable regulation on branch and rural circuits in thirty-two 5/8% steps. As with all G-E station-type voltage regulators, controls of the ML32 maintain Class I accuracy.



IRT three-phase induction regulators combine three single-phase IRS regulators in one tank with a single set of controls. They provide high quality stepless regulation for balanced loads. Rugged construction assures long life.



MLT32 three-phase step regulators adjust voltage in thirty-two 5/8% steps. Best suited for lines with balanced loads, they feature rugged simplicity in construction—accessibility and ease of maintenance of switching mechanism.

Solve any feeder voltage problem with one of these G-E regulators

You can get exactly the type of voltage correction you need . . . dependable, low-cost regulation . . . the finest regulation obtainable . . . for circuit capacities from 125 kva at 2.4 kv to 25,000 kva at 69 kv . . . by choosing from General Electric's complete line of voltage regulators.

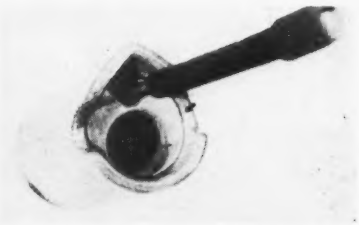
G-E Induction Regulators, with their prompt response to voltage variations, smooth stepless control, and negligible maintenance, provide the highest quality regulation obtainable. They're available for circuits 15 kv and below, 3000 kva and below . . . single-phase for individual phase control . . . three-phase for balanced loads.

G-E Step Regulators offer economic advantages where you handle large blocks of power at higher voltages, and where you need supplementary regulation on your branch and rural feeders. G.E.'s MLT32 three-phase step regulator is available for all standard voltages up to 69 kv, circuit capacities up to 25,000 kva . . . ML32 single-phase regulators offer ±10% regulation in thirty-two 5/8% steps in ratings 13,800Y/7960 volts and below, for three-phase banks rated approximately 2000 kva and below.

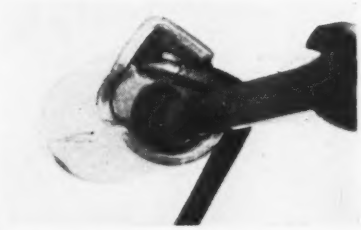
For more information on IRS, IRT, MLT32, ML32 regulators, see your local G-E representative or send for bulletins GEA-2985, GEA-2985C-1, GEC-716, GEA-5752, respectively. General Electric Company, Schenectady 5, New York. 423-2

GENERAL ELECTRIC

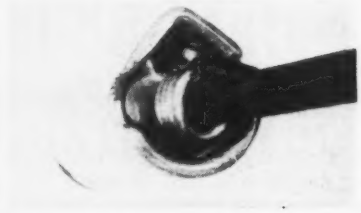
MAKING CONNECTIONS with a gun-like tool has decreased the required working time, eliminated the soldering procedure and is responsible for the reduction in size of equipment



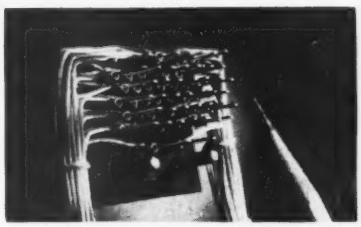
1. Skinned wire is inserted into spindle of gun-like tool



2. Axial hole is fitted over terminal of relay



3. Wire is wound around terminal as spindle rotates



4. Finished solderless connections are tightly wound

Wrapped Wire Solderless Connections Cut Installations Costs

A solderless connection made by wrapping wire around a terminal with a gun-like tool has been developed jointly by Western Electric Co and Bell Telephone Laboratories. The wrapped connection reduces labor cost per joint, removes the human element in soldering and reduces space requirements for equipment.

The hand-held tool for making solderless connections has a rotating spindle with an axial opening that receives the wire terminal. A second opening, radially separated from the axial opening, is provided for inserting the skinned end of connecting wire. The tool rotates its spindle, winding the wire around the terminal in a tight helix, making a firm mechanical joint.

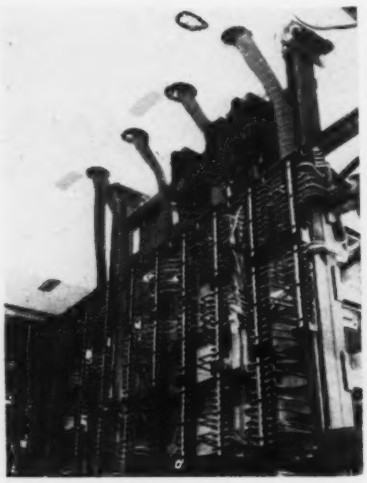
Terminals, rectangular in cross section having edges such as produced by a punch press, are wrapped with about six turns of wire under high tension. Result of this tension is an indentation of wire at each terminal corner, which requires a force of approximately 10 lb to strip from the terminal. Contact pressure is at least 15,000 psi for the connection life. Solid-state diffusion improves the bond with time.

Tests conducted by the developing engineers prove the solderless wrapped-wire connection are faster and more easily made than soldered ones. They are mechanically stable, less apt to break through rough handling or vibration, and have a life expectancy of 40 years without measur-

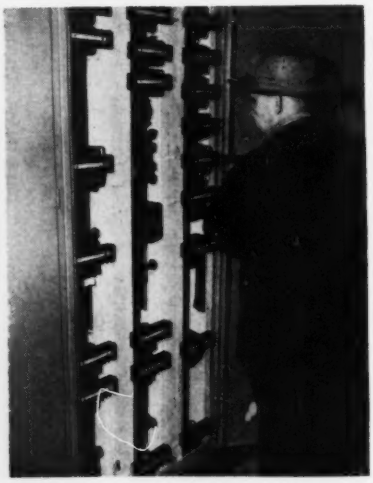
able resistance variations. Differences in thermal coefficients of expansion between copper wire and nickel-silver or brass terminals have a negligible effect on the joint tightness of connections.

Terminals can be smaller in cross section and spaced more closely together for wrapped than for soldered connections. Because of this relays and other equipment can be reduced in size.

INDIVIDUAL SECTIONS measuring about 10 x 21 in. comprise 230-kv relay board. Screw in each corner holds sections to steel



TERMINAL RACKS in basement below relay racks and control panels aid in wiring and provide for mounting of auxiliary devices



CHANNEL IRON GUTTERS with tapped holes and knockouts every 6 in. make for easy mounting and wiring of the terminal blocks

Sectionalized Panels Provide Flexible Board

Flexibility in installing and changing relay equipment at Bothell Substation of Seattle City Light is provided by relay boards with sectionalized panels. Use of these panels simplifies cutting holes when installing new equipment and eliminates filling in a hole whenever a relay is removed or replaced.

Rectangular panel sections, each measuring about 10 x 21 in., hold one protective relay or one or more auxiliary devices. To simplify cutting and to make manufacturing tolerances less noticeable, latest sections are made of flanged sheet metal pans in place of heavier flat plates. Twelve pans or plates are mounted on a rack, which measures 30 in. wide, 96 in. high, and 14 in. deep. Corner screws attach each section to vertical rack members.

Another advantage of panels is that racks can be shop wired when cases with removable relays are used. Cases are mounted and wired in the shop while relays are tested and calibrated by the relay division. After rack is in place, relays are inserted and final circuit checks are made.

Terminal blocks are mounted behind relays, with channel shaped wiring gutters used for support. Knockouts spaced 6 in. apart vertically allow for convenience in wiring. In some cases field wiring is brought directly to these terminal blocks through wiring gutters. At Bothell, however, terminal racks were placed in basement below relay boards. Terminal racks eliminate congestion, provide mounting place for auxiliary transformers and the like, and aid in making required interconnections.

Cables from 230-kv and 115-kv switchyards terminate in basement rack and only necessary wires are run through floor to relay racks above. Other wires are run to control boards, auxiliary current transformers, distribution panels, etc, using wiring trays that are part of terminal racks.

Drying Oven Cuts Maintenance Costs

O. E. FAWCETT, Maintenance Engineer, West Penn Power Co, Pittsburgh, Pa.

Drying transformers in a special oven has provided West Penn Power Co with a convenient and efficient method that has effected savings in maintenance costs. The oven operates on principle of removing moisture from intake air, and thus supplies dry air of a greater moisture tolerance to reduce the drying time. It was designed to:

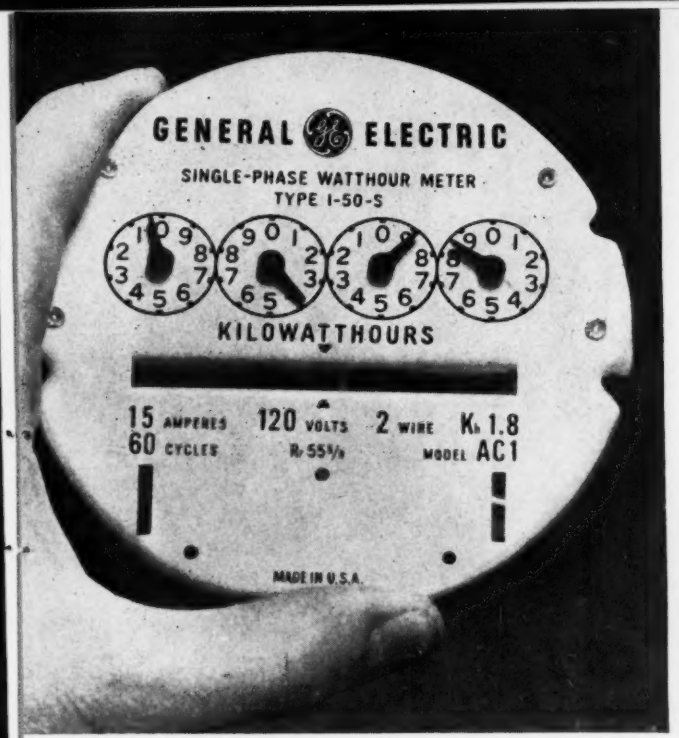
1. Permit hauling on highways rather than moving transformers to the oven's location.

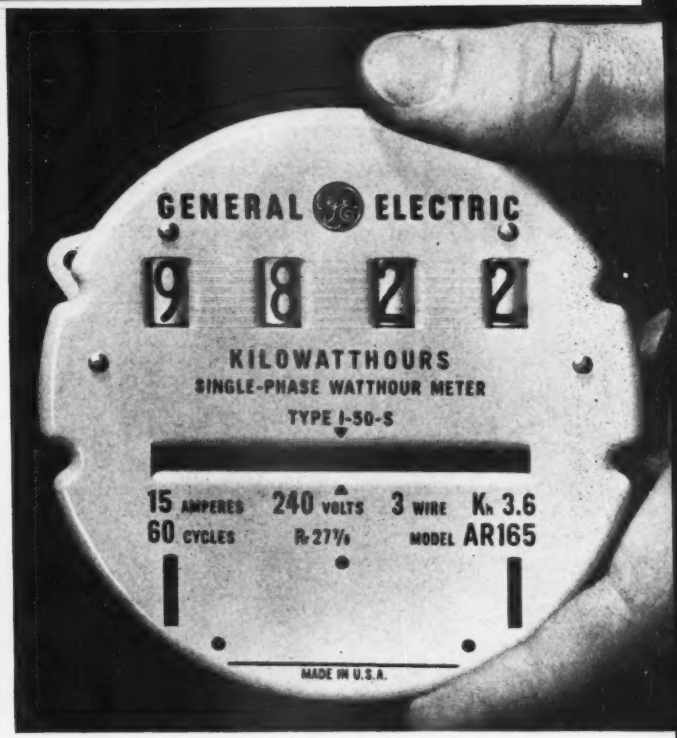
2. Reduce the cost of drying by permitting drying equipment operation without much direct supervision.

3. So improve the drying method that time and energy required would be minimized.

4. Eliminate fire hazards.

(*Continued on page* 146)





With either the pointer register . . .

Or the snap-action cyclometer register . . .

Extra-large Numerals on G-E I-50 Meters Reduce Reading Time, Cut Costly Errors

General Electric certified I-50 watthour meters, with simplified, legible registers, facilitate meter-reading and reduce costly reading errors. With the ease of reading afforded by the cyclometer-register design, new meter readers can be trained quickly and dependably, saving time for meter foremen.

ACCURATE READINGS with the cyclometer register are much easier because the figures are extra-large. And magnetic snap-action trips the cylinders to make sure that no half-numerals are showing. This legibility greatly facilitates self-billing and also helps in eliminating billing errors, customer complaints, and rereading.

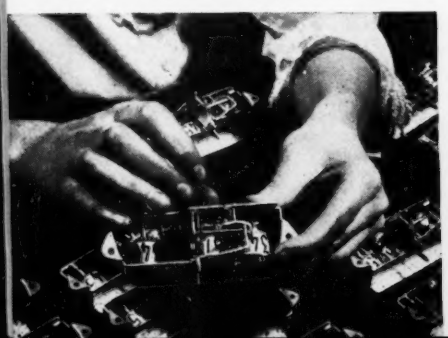
FOR MORE INFORMATION on the G-E certified watthour meter, see the color movie "Accent on Accuracy." Call your nearest G-E representative or write General Electric, Schenectady 5, N. Y. 601-98

EASY-TO-READ cyclometer register on I-50 watthour meter has figures four times the conventional size.

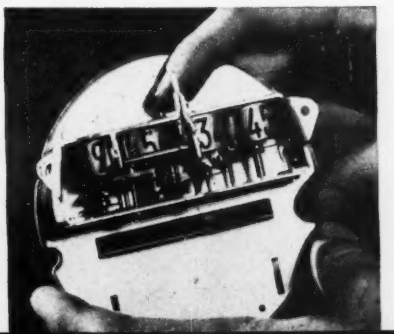
You can put your confidence in—

GENERAL ELECTRIC

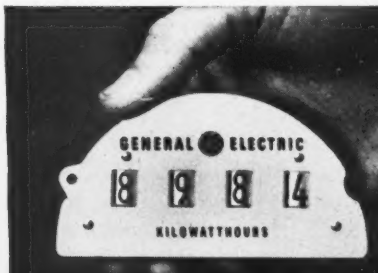
REGISTER ACCURACY is assured by frequent factory inspections to give dependable, maintenance-free performance.



FAST RESETTING is easy with plunger to de-mesh gears for first two cylinders. Vertical shafts reduce friction.



SEPARATE REGISTER for installation on present meters makes large-figure legibility available for all meters.



READY TO START moving the 750-kva General Electric network transformer, with submersible protector, from trailer to vault. Notice the room air-conditioning units in the windows—one of the reasons why more capacity is needed here.

Potomac Electric, Washington, D.C., installs G-E network unit to meet extra-heavy load demands

System reinforced with 750-kva G-E transformer and network protector

The flexibility and ease of expansion provided by a secondary network system certainly "pays off" for Potomac Electric Power Company in downtown Washington, D. C. Flexibility of the system permits load growth additions with minimum interference to service in the highly concentrated downtown area.

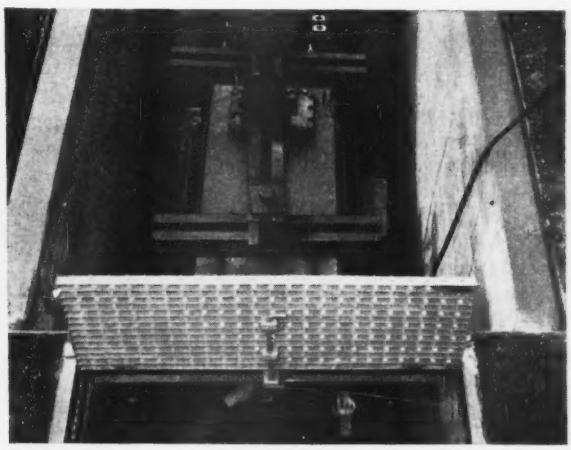
The financial district is experiencing a phenomenal growth and the consequent heavier load requirements, including air-conditioning in existing buildings in the area, necessitated installation of this 750-kva G-E network transformer. The unit, equipped with a submersible automatic network protector, is located at 730—15th Street, N. W., directly in front of the American Security and Trust Company building.

Compactness of G-E network units permits minimum vault depth (7 feet to roof slab) for lower installation cost.

It pays to start a network. Although the change from a radial to a network system means substantial initial expense, future increases in capacity require less investment with a network system. With a growing load, the sooner the network system is started, the lower the ultimate cost. Why not investigate the advantages for your system?

For help in solving your network problems, and for complete information on the many advantages of G-E standardized network units, get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5024, General Electric Company, Section 431-201, Schenectady 5, N. Y.

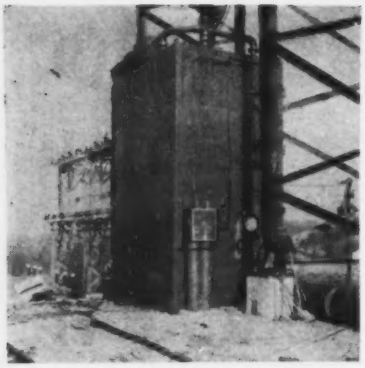
ALMOST IN PLACE and with minimum inconvenience, even in a congested downtown area. Note the G-E submersible automatic network protector on the low-voltage end of the transformer.



CENTERING UNIT in vault prior to cabling. Convenient location of cable terminals on G-E units makes minimum size vaults practical—simplifies connections for fast installation.

You can put your confidence in—

GENERAL ELECTRIC



TRANSFORMER DRYING OVEN, designed to be moved to different sites rather than moving "wet" transformers to it, has cut costs

Drying Oven

(*Continued from page* 142)

The oven is built of a sheet-steel box with 3 in. of zonolite insulation in the walls. It is 7 ft 9 in. by 9 ft 6 in. by 15 ft 7¾ in. and weighs approximately 8 tons.

Thirty-three kw of electrical strip heaters are installed inside the oven. They are arranged so that manual control of 6, 6, 10 and 18 kw, and thermostatic control of 9 kw can be obtained. Therefore, heating can be controlled from zero to 33 kw. Transformer winding temperature is recorded and an indicating thermometer shows air temperature within oven.

Two small fans are located at the oven's top. They take air from either top or bottom of oven and either exhaust it to atmosphere or return it through a silica-gel filter, hence through an induced draft fan, to the bottom of oven. Purpose of silica-gel filter is to remove moisture from the air and reduce amount of heat required to maintain oven temperature.

Eye bolts are located to permit pulling heavy transformer cores into the oven without damage. Provision is made for testing transformer windings without opening the oven during drying. Fire protection is provided by an automatic carbon-dioxide system.

Three 2,000-kva, 25-4-kv transformers and three 5,000-kva, 132-25-kv transformers have been satisfactorily dried with this oven to date. Further development is contemplated in an attempt to further reduce drying time with safety.

Adapted from a paper presented at a recent Doble Clients Conference in Boston.

Test Bench Provides Accuracy and Safety

FRANK A. REDDING, Supt

DORR KIMBALL, Lab Technician,
Shop and Test Division, Southern California Edison Co, Alhambra, Calif.

Accuracy, flexibility, convenience and safety are provided in an instrument transformer test bench built by Southern California Edison Co. Unit is used in making ratio and phase-angle tests on potential transformers rated up to 18 kv and current transformers up to 5,000 amp. Major part of bench design was done by co-author Kimball.

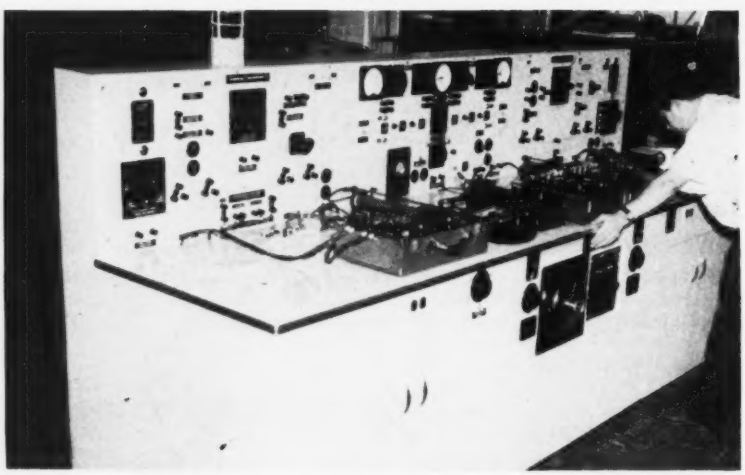
Features of new bench are based on 20-years experience with previous unit. For example, larger wire, No. 6 for secondary circuits and No. 12 for others, reduces resistance of circuitry. Soldered connections and low-contact-resistance switches with silvered contacts insure permanent low resistances.

Unlike old unit, new bench is wired so that contact resistance of switches in secondary circuits may be checked when necessary. For circuits that are changed infrequently, test links are used instead of switches. Most stray fields are eliminated on new bench by running all secondary leads in pairs. To minimize stray fields produced by heavy currents, the 200-amp induction regulator in current transformer loading circuit is located in another area with leads running to rear of test bench. Regulator is controlled from bench, however.

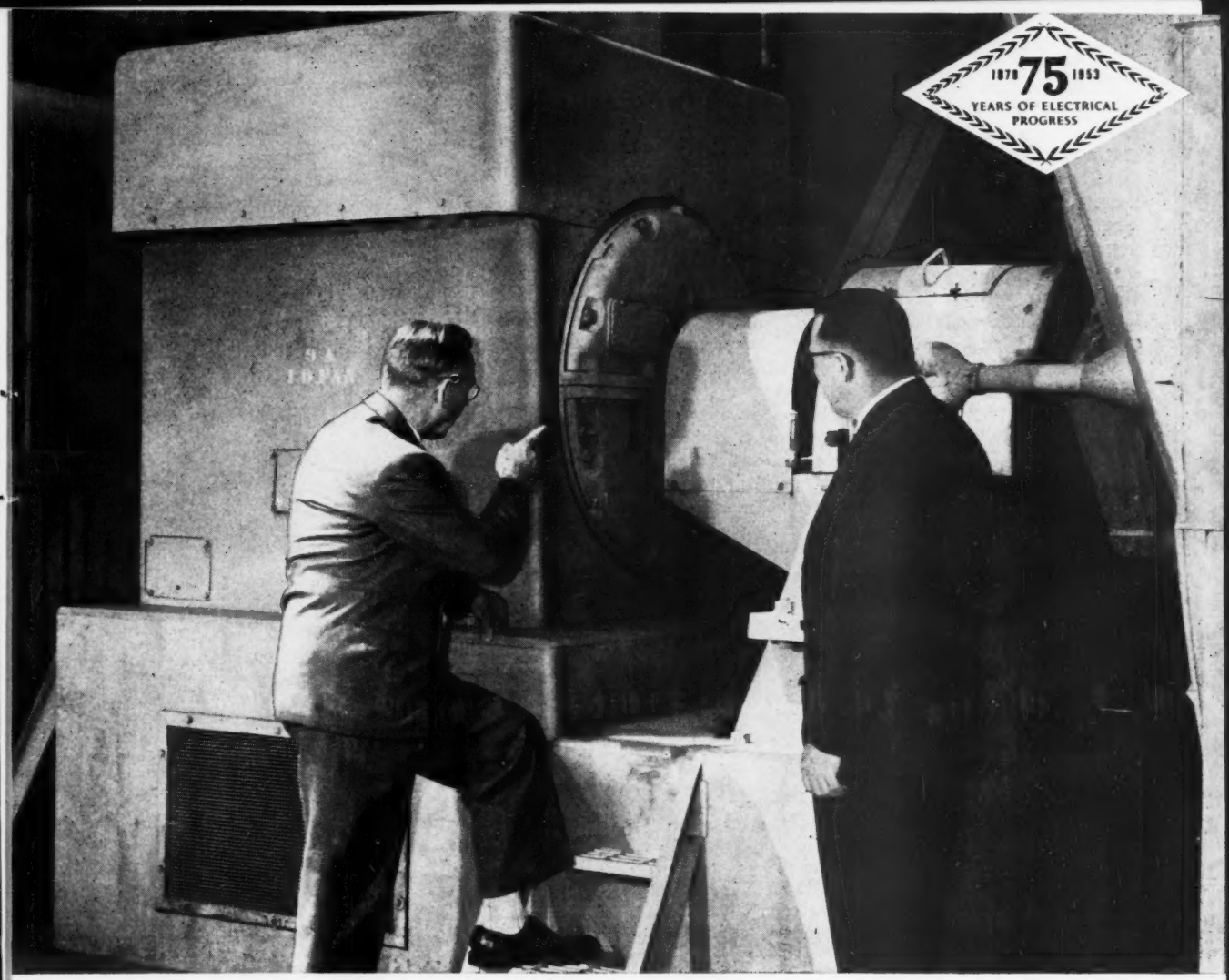
New unit has four methods of testing both current and potential transformers to assure consistent test results. Current devices are checked by current transformer test set, detector wattmeter method, two watthour meter method using two rotating standards, and compensated standard current transformer method. Make-before-break switches allow switching of secondaries under load without opening circuits.

Potential transformers are checked using potential transformer test set, detector wattmeter, two watthour meter method with two rotating stand-

TEST LEADS for current transformers are at back of bench, along with loading transformers



INSTRUMENT TRANSFORMER TEST BENCH is designed on basis of 20-year experience with old unit. Four different means are provided for accurately testing potential and current transformers. Flexibility, convenience, and safety are other features



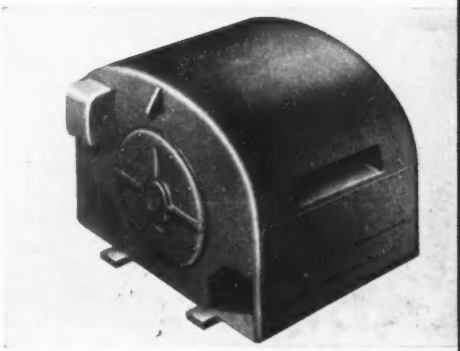
DALLAS POWER & LIGHT SAYS:

"G-E Weather-Protected Motors Give Us Dependable Service."

The Dallas Power & Light Company reports complete satisfaction with G.E.'s Weather-Protected Motors, used to drive induced draft fans. Developed by General Electric in 1949, they are the first successful outdoor ambient breathing motors—give outdoor protection at lowest possible cost.

General Electric's Weather-Protected Motors are available as Base Ventilated for high shaft applications and as Grade Mounted for low shaft applications. They have an effective low air velocity, air reversal system which practically eliminates moisture, dust, and other foreign materials from the cooling air.

For full data, contact your G-E Apparatus Sales Office or write for Bulletin 5810 to General Electric Co., Section 753-4, Schenectady 5, New York.



GRADE MOUNTED Weather-Protected Motors are designed so that driven rain, etc. blows *through* the air inlets—not into motor.

GENERAL ELECTRIC

ards, and standard resistance method. Any method of testing may be set up quickly, with only a few external leads required for connecting instruments. On new bench some draw-out leads are connected permanently but may be cut out electrically by moving four links for each associated device.

For greater convenience, new bench layout from left to right is: potential transformer control, potential transformer secondary, phase control and metering for auxiliary circuits, current transformer secondary, and current transformer control. Auxiliary circuits' subsection consists of two three-phase phase shifters, each supplying single-phase secondaries with voltmeter, ammeter, power-factor meter, and associated switches. Instruments may be switched into various circuits as required. A simplified schematic diagram on a vertical panel fastened securely to the bench illustrates the connections of all important circuits.

Standard burdens are available through a rotary switch while special burdens are provided through an adjustable burden box. Links connect special burdens to any transformer secondary. In addition, these links cut in standard lead resistances, and connect special lead resistances that are required.

Safety Features . . . To reduce hazards of high current and voltage, new bench has loading transformers and current and potential transformer standards located in closed space back of unit. Transformer test area back of bench is closed off by a barrier. Interlock plug in barrier gate de-energizes both current and potential sources when gate is opened. Plug also provides visible break in potential supply for anyone inside of the test area.

Safe operation is aided by red and green pilot lights that indicate positions of all switches and breakers. In addition, large red warning light, visible from all sides of bench, burns when potential transformer circuit is energized.

Main panel of bench is made of ½-in. fiber board and working area is grey linen finish, wear-and-heat-resistant plastic. Rest of bench is made from ¾-in. plywood on a sturdy frame of 4 x 4-in. and 2 x 4-in. lumber. Bench is painted light grey inside and out.

Aluminum Glyptal Seals Welds

A. F. PFANDENHAUER, Foreman Equipment Repair, Electrical Construction Department, Shops and Tool Service, Commonwealth Edison Company, Chicago

Painting of seams and welds on transformer cases with a mixture of aluminum powder and glyptal has solved the problem of leaks that sometimes, in the past, involved expensive repairs. The aluminum powder-glyptal mixture seals the welds and prevents leaks.

The mixture is prepared by adding to one tablespoon of flake aluminum powder, three tablespoons of glyptal cement and sufficient glyptal thinner to give a mixture the consistency of paint.

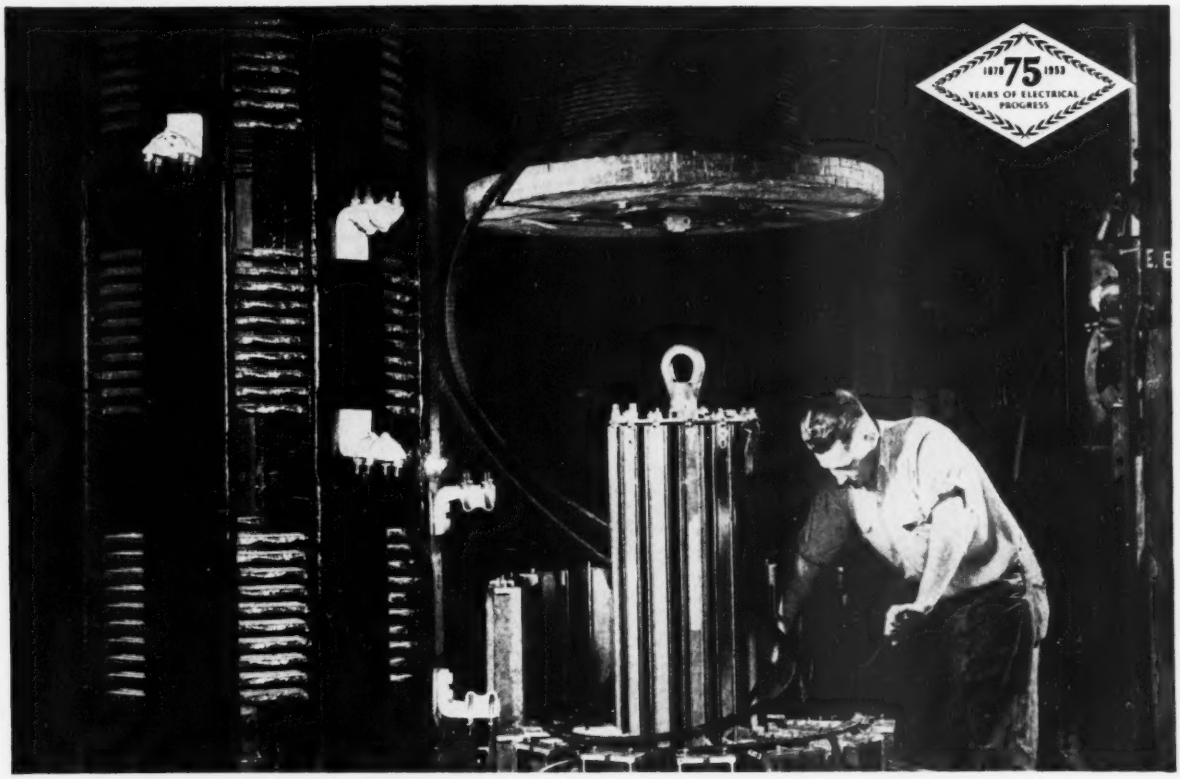
After the transformer cases have been cleaned, this mixture is painted over the weld. When dry, a brushing of glyptal is applied over the painted areas. The case is ready now to receive the protective finishing paints of one coat of red lead and another coat of the desired color.

SEALING WELDS of transformers with an aluminum glyptal mixture prevents oil leaks

Sawdust Blasting Cleans Motor Windings

Sawdust blasting, an inexpensive and easy method of cleaning motor windings, has been developed by John Barkhaus of the Indianapolis Power & Light. Sawdust, costing only 25¢ a barrel, is sifted into a sprayer and forced by compressed air through a hose and nozzle onto the coils to be cleaned.

Coils have been cleaned in the past by applying a solvent to dissolve the oil and dirt film. Another method that is used by some companies is to blast the winding with ground up corn cobs. But sawdust is less expensive.



Save 10% on new G-E reactors with aluminum conductors

Same long life, same low maintenance, same high short-circuit strength . . . at 10% less cost

Now you can save 10% by buying General Electric cast-in-concrete reactors with *aluminum conductors*. These new G-E aluminum reactors will give you the same dependable performance—the same high degree of protection—as G-E units built with copper . . . at 10% less cost. There has been no sacrifice in the reactor quality that has been the favorite of industry for more than 35 years.

The "extra service" features of G-E reactors—both aluminum and copper types—that provide practically unlimited life and make maintenance a minor factor, include:

Non-aging glass insulation which assures greater protection against turn-to-turn short circuits than any other type of wound insulation used in reactor manufacture . . . withstands extremely high temperatures . . . remains unaffected by moisture and will not deteriorate even under high overloads.

Continually transposed conductors assure more uniform current-distribution . . . reduce losses, and increase short-circuit strength.

Wet steam curing assures full strength of concrete at shipment—no dangerous waiting period which occurs if concrete must cure after reactor is placed in service.

Other features include: good clearances; crossovers made within concrete supports; smooth, flameproof black japan finish and silver-plated terminals.

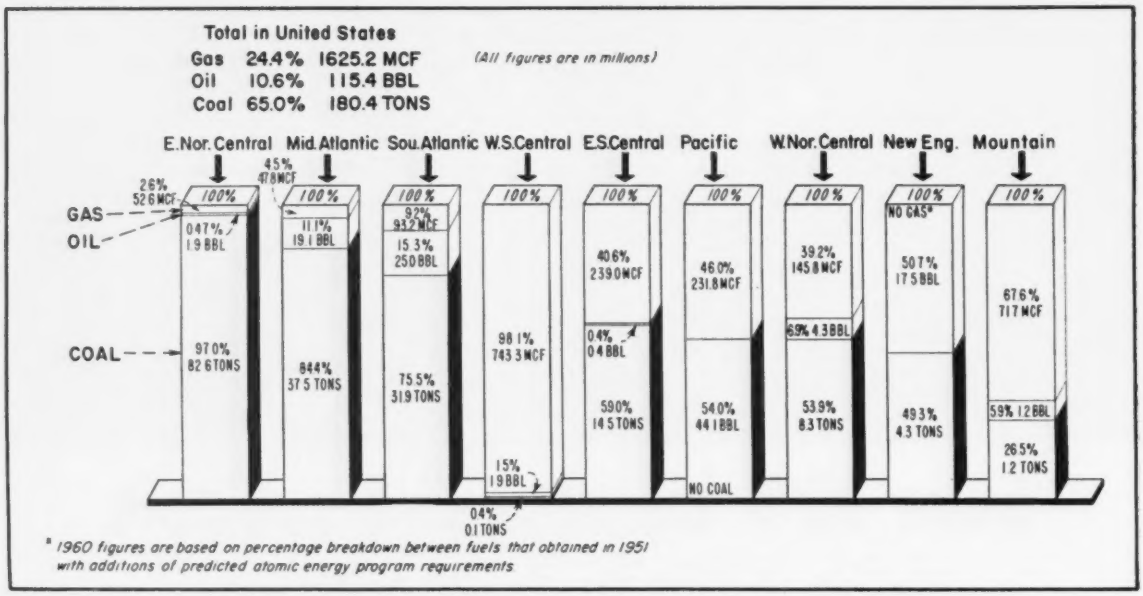
Metal housings, with provisions for cable entrance and exit can also be provided that will match the appearance of G-E switchgear. These housings minimize stray currents and electrical losses, protect reactors against damage, and increase safety for personnel.

You can buy these sturdy, dependable G-E cast-in-concrete reactors with either aluminum or copper conductors. For full information contact your nearest G-E Sales Office or write General Electric Company, Section 422-5, Schenectady 5, N. Y.

You can put your confidence in—

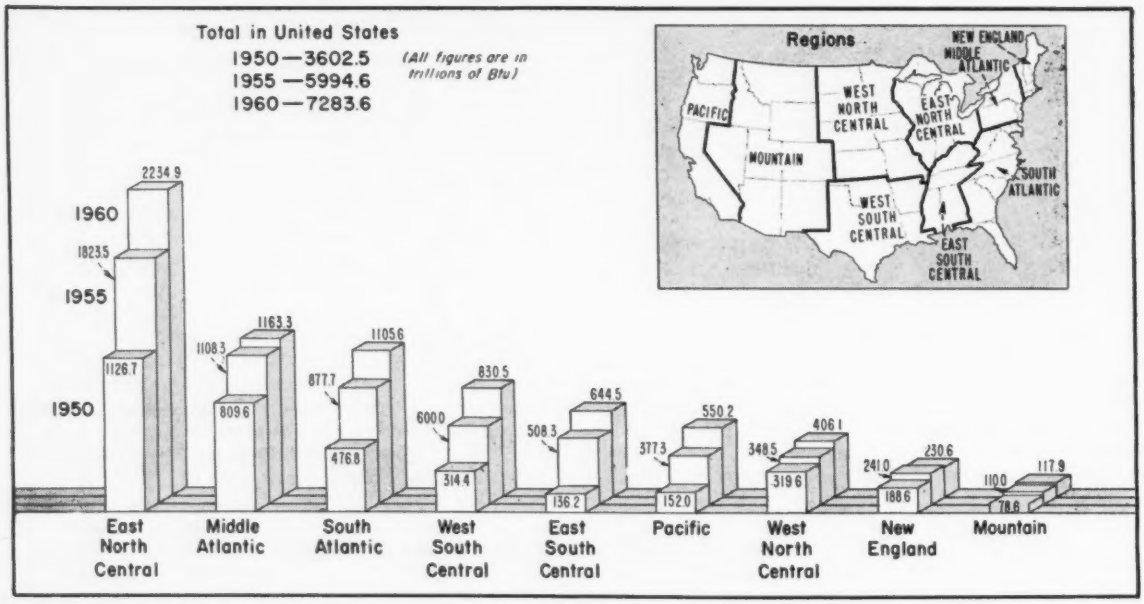
GENERAL ELECTRIC

Heat and Fuel Requirements for Thermal-Electric Generation in 1960



* 1960 figures are based on percentage breakdown between fuels that obtained in 1951 with additions of predicted atomic energy program requirements.

Gas, Oil and Coal Requirements



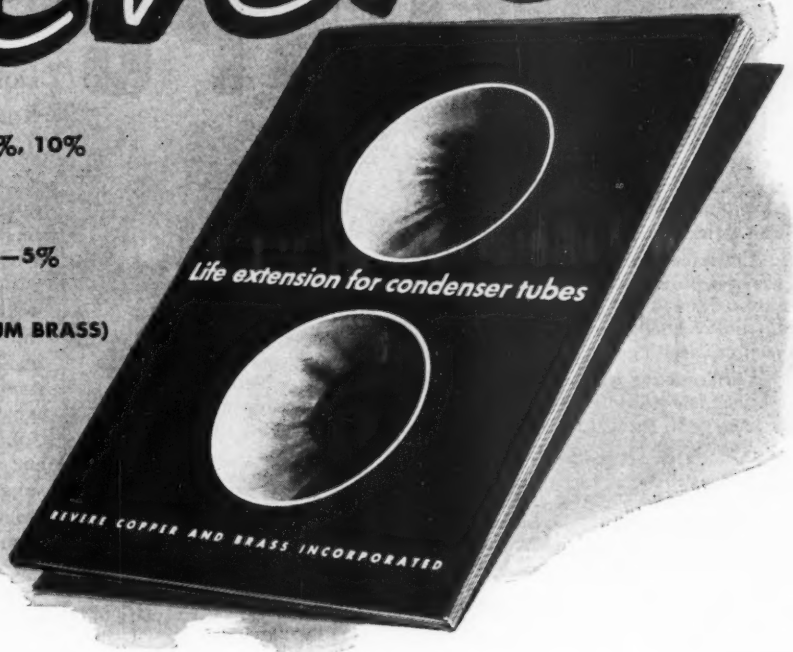
Regional Btu Requirements

Requirements for the United States are given for private electric utilities, public electric utilities, and industrial plants. These data for this 1960 forecast were compiled by Ebasco Services, Inc, New York, N. Y.

FOR CONDENSER AND HEAT EXCHANGER TUBES AND PLATES SPECIFY

Revere

CUPRO-NICKEL—30%, 10%
ADMIRALTY METAL
ARSENICAL COPPER
ALUMINUM BRONZE—5%
MUNTZ METAL
REVALON (ALUMINUM BRASS)



• Correct selection is essential if tubes and plates are to serve with the maximum economy and minimum trouble. The Revere Technical Advisory Service and Revere Research Department are always ready to collaborate with equipment manufacturers and operators in specification matters. • When it is time to re-tube, remember that conditions may have changed since the original installation, and that it may be wise to re-check before ordering new tubes. • To take advantage of Revere's knowledge of copper and copper alloy tubes for all industrial purposes, get in touch with the nearest Sales Office. See your telephone book or write direct. Send for helpful booklet, "Life Extension for Condenser Tubes." Free.

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COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

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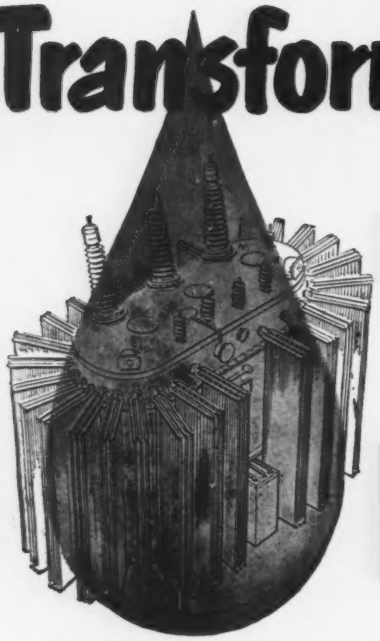
Transformer Oils last longer with DBPC



WHEN Di-tert-butyl-para-cresol (DBPC) is added in liquid form to transformer insulating oils, their resistance to oxidation is increased and their useful life is greatly extended.

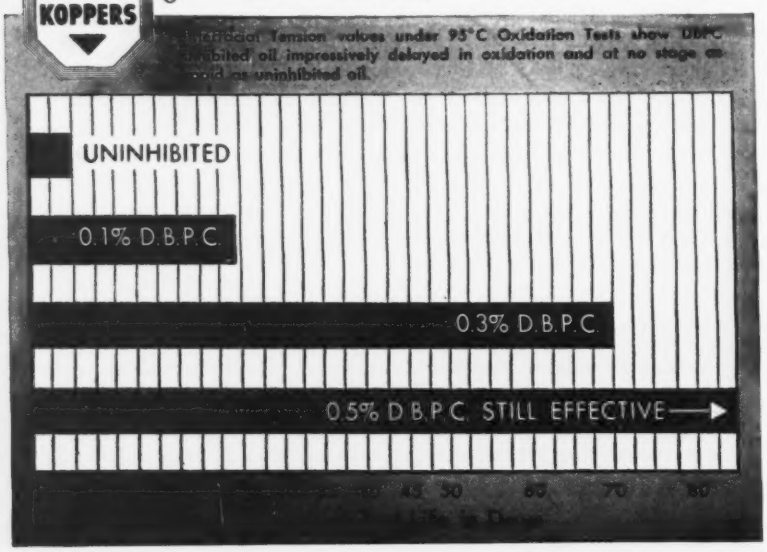
The value of Koppers DBPC as an inhibitor for new or reclaimed oil has been proved. Actual use has confirmed the accelerated oxidation tests shown below. Further, many manufacturers of transformers now endorse the use of DBPC, and most major suppliers of transformer oil will, on request, furnish new oil that has been inhibited.

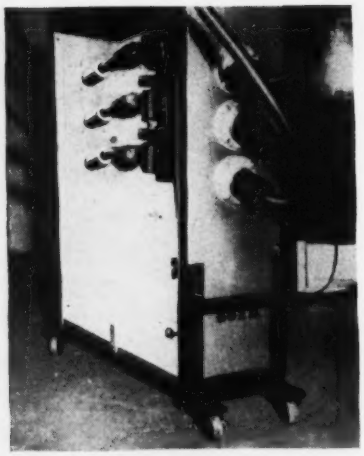
When ordering new or make-up transformer oil, make certain it is inhibited. And use DBPC to prolong the life of your reclaimed oil. The savings you'll get will be worth your while.

If desired, we can furnish a compounded oil solution of DBPC called Impruvol 20. Impruvol 20 can be used with simple equipment. Its application presents no more problem than the application of insulating oils themselves. Order Koppers DBPC or Koppers Impruvol 20; the choice is yours.

KOPPERS ®

KOPPERS COMPANY, INC.
Chemical Division, Dept. EW-7133, Pittsburgh 19, Pa.





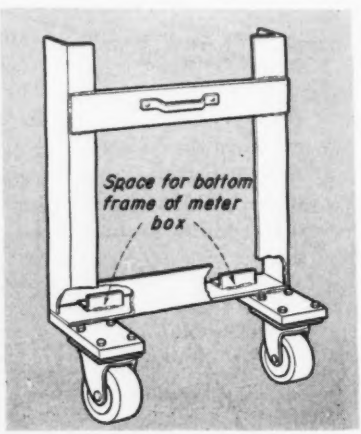
TWO DOLLIES hold a meter box, thus aiding handling problems. Dolly load is 250 lb

Dollies Make Meter Box Handling Easier

Handling heavy primary meter boxes by meter department personnel of Central Power & Light Co has been simplified by "made-to-fit" dollies. They are made from 1¼ x 1¼ x $\frac{3}{16}$-in. angle iron cut to fit the meter boxes, welded together and mounted on casters. Two short lengths of ½ x ½ x $\frac{3}{16}$-in. angle irons are welded to the transverse member of each dolly as shown in the sketch. Sufficient space is provided between these small angles and the vertical section of the transverse member, on which angles are welded, to accommodate the thickness of the meter box ends.

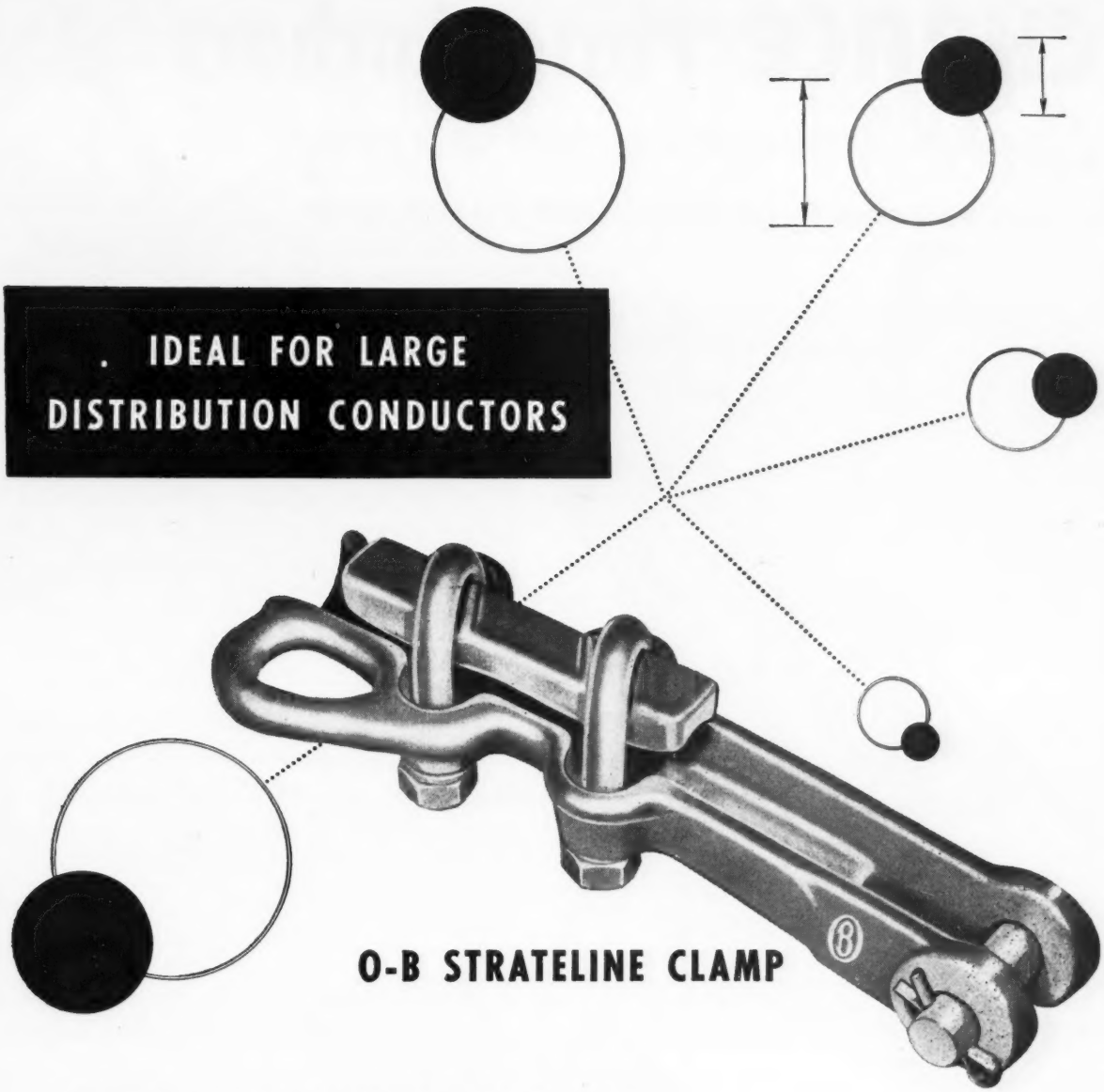
The small angles project into the bottom frame of the meter box to prevent the dolly slipping out of place.

(*Continued on page* 156)



SMALL ANGLES and vertical section of transverse member provide space for the end of a meter box to fit into

. IDEAL FOR LARGE
DISTRIBUTION CONDUCTORS



O-B STRATELINE CLAMP

Here's an inexpensive and highly effective deadend clamp for aluminum primary distribution conductors, especially in the larger diameters. Only five stock sizes of the O-B Strateline clamp will accommodate cable sizes from 0.15 to 1.55 inches--offering a still further economy in stockroom inventory. Holding strength and safety factors are generous for distribution service. Size and shape adapt the clamp ideally to restricted phase clearances, and facilitate the application of protective shields for hot line work. The entire Strateline group is duplicated in malleable iron, aluminum, or bronze to offer a free choice of cable-matching combinations.

Consisting of a re-design of a long-used O-B item, the modernized Strateline clamp offers the added advantage of long, successful service experience.

For extended range of cable diameters, ideal adaptation to distribution requirements, full choice of body metal, and attractive low cost, specify O-B Strateline clamps for your primary line construction.

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4387-H

CHANCE Plate Anchors

Speed Transmission Guying

...SAVE MAN HOURS—CUT COSTS—HOLD GREATER LOADS

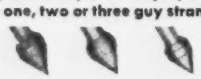
CHANCE NEVER-CREEP ANCHORS

You gain two ways when you choose Never-Creep Anchors for guying transmission or heavy distribution lines. First, they can be installed in machine bored holes because the size of the hole makes no difference in the holding power of the Never-Creep. Second, these anchors pull entirely against solid, undisturbed earth because the hole is at an angle away from the guy.

Never-Creep anchor plates are formed of high strength structural steel and are reinforced in the area of greatest pull with a high carbon steel core plate and the socket or "rod lock" plate which has reinforcing ribs. Dual-purpose creep guards keep the anchor from creeping up the hole and guide the rod point into the socket.

Circle shows reinforcing plate and rod socket.

Chance Anchor Rods, for use with the Never-Creep, are drop forged with a Thimbleye, Twineye, or Tripleye for use with one, two or three guy strands.



CHANCE CROSS-PLATE ANCHORS

The Chance Cross-Plate Anchor helps speed up big line construction jobs. It replaces improvised "dead-men" and can be installed in slanted or vertical machine bored holes in any kind of soil. This all-steel anchor compares in cost with an average 4 foot treated log.

Laboratory tests on a Chance X-24 Cross-Plate proved it capable of indefinitely withstanding a pull of 70,000 lbs. with only slight bending, while a creosoted log split under a 20,000 lb. pull in a few hours.

Nut retainer aids installation.

You know it's RIGHT when you specify CHANCE

A·B·CHANCE CO·

CENTRALIA, MISSOURI

SAN FRANCISCO, CALIFORNIA

Reprints of the opposite page for your bulletin board, or for distribution to your men, are yours for the asking. Request Form 41, Plate Anchors. Write A. B. Chance Company, Centralia, Missouri.

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

C53-8

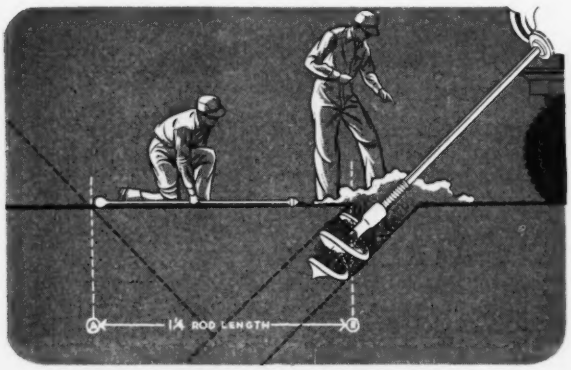
NUMBER THREE OF A SERIES

TIPS FOR BETTER ANCHORING...

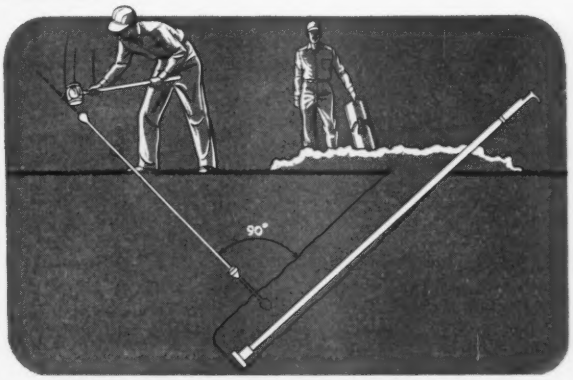
How to install Plate Anchors

Plate anchors can be installed in machine bored holes because the size of the hole has little to do with the anchor's holding power. This makes plate anchors ideal for big construction jobs, and their great strength makes them a sound choice for transmission line guying. Plate anchors of the Chance Never-Creep type are best used where space permits a guy angle of 45° to 60° with the ground line.

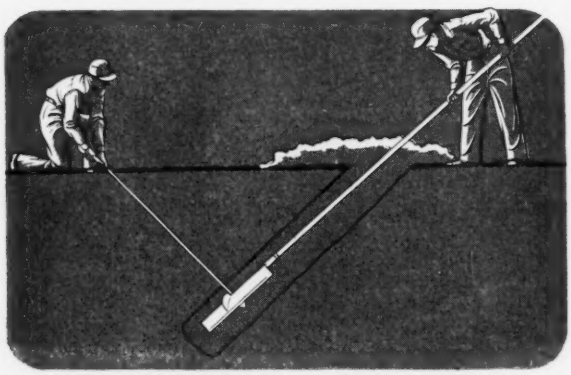
The A. B. Chance Company, pioneer in the field of plate anchors, offers these suggestions for best and fastest installation...



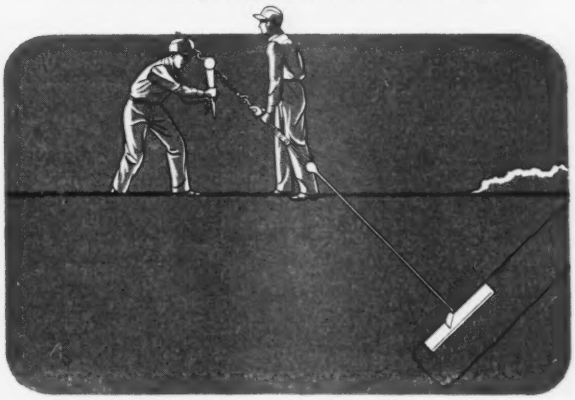
1. Locate spot where guy will come to ground. Edge of hole should be 1¼ times rod length. Aim auger toward pole and bore hole at 90° angle to guy.



2. Drive the rod. Aim for the center of the hole. You can use the installing bar, placed in the hole, as a target.

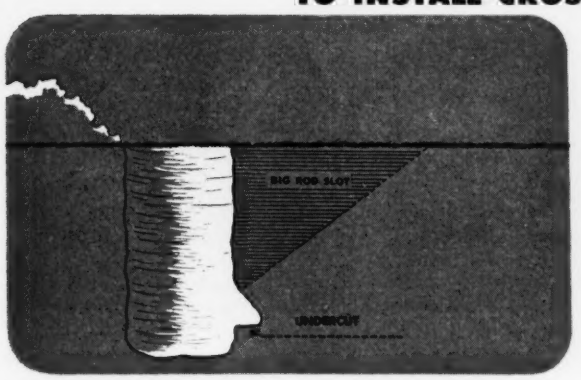


3. Hang plate on rod, using an installing bar. Hole should be deep enough for plate to swing free of bottom so the rod head can be fully seated in the socket.

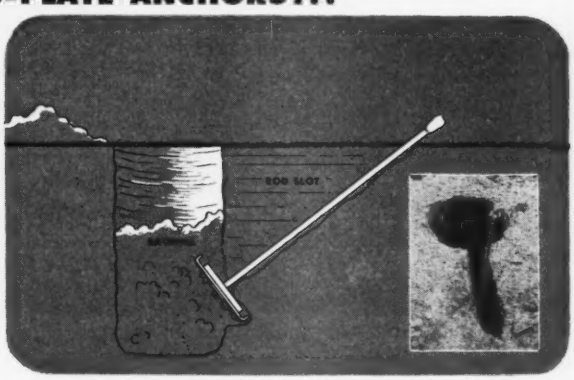


4. Remove installing bar and pull anchor firmly against top of hole; tighten the guy... then fill the hole.

TO INSTALL CROSS-PLATE ANCHORS...



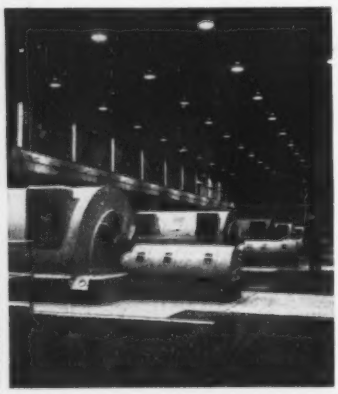
1. This anchor is installed like a log "dead man". Can be installed in a single machine bored hole. Undercut to get a leverage against solid earth.



2. Cut slot for rod. Lay anchor into position. Hard and complete tamping of each spade of backfill is necessary for a good installation.

what's NEW in Engineering

The "swing and spill" hazard in conventional hook and crane hoisting may soon be a thing of the past, according to a midwestern laboratory. It has developed a new crane which substitutes an automatic mechanism, controlled by a small knob, for the usual operator's controls. The result is a smoother, controlled hoist. So new, this crane is still in scale model stage.



A power plant large enough to serve a city the size of Akron, Ohio, is just part of the nation's largest aluminum reduction plant designed and built by Kaiser Engineers. Installed capacity of the combined gas engine and steam generating facilities is 473,200 kw of power. A maximum of 140,000,000 cubic feet of natural gas is consumed per day. Speed was essential, so Kaiser Engineers had the plant producing power only eight months after groundbreaking. We'll send you an illustrated folder on request.

Instrument Engineering is a valuable new book by Draper, McKay and Lees. In two volumes (the second out this June), it is a comprehensive reference book for the practicing engineer—and an outstanding contribution to the theory of instrument engineering.

Incidentally, Kaiser Engineers has approximately 600 professional engineers, technical experts and staff ready to tackle your problem in design, engineering or construction. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

(*Continued from page* 152)

The weight of the box, when set properly on two dollies, forces the dolly top members against the box ends because of the offset casters. This causes the meter box to be held snugly in place.

The dollies, developed by Thomas Kozelski, meter tester, have a capacity of 500 lb per pair.

Batteries Unharmed by Fluorine-Treated Water

Fluorine-treated drinking water is not harmful to storage batteries, provided the water was harmless before fluorine was added. This was the conclusion of tests conducted at Gould-National Batteries' laboratory at Depew, N. Y.

Drinking water treated with fluorine normally contains two parts of fluorine per million parts of water. As water evaporates and is replaced, fluorine accumulates in cells and may reach a concentration as high as 30 parts per million under most unfavorable circumstances.

To simulate accumulation of fluorine, the laboratory added 86 milligrams of sodium fluoride to one cell in each of three industrial batteries. Batteries were then put on life test that took them through their life span in accelerated time.

Cells in each battery were observed throughout the test until all failed. Those containing fluorine showed no unusual behavior and did not fail before the other cells.

Over-Sized Puller Aids Fuse Replacement

IVAN E. GOODNER, Electrical Engineering Associate, Department of Water and Power, Los Angeles, Calif.

Use of an oversized fuse puller has simplified replacement of 34.5-kv power fuses, which are mounted about 11 ft above ground level. An additional 1-ft clearance for operating space in front of fuse over that necessary to open fuses is the only requirement in using new puller.

Type of fuse used by the Department weighs about 27 lb. Replacing fuse from a ladder is cumbersome and unsafe, and use of a platform within easy working distance was ruled out by State safety orders.

PADDED JAWS added to actuating mechanism of standard adjustable insulator fork comprise oversized fuse puller. Operating head is attached to 1½-in. diameter, 8-ft spruce pole. Turning stick closes clamp

New pulling device has solved the problem. It is a modified standard adjustable insulator fork and is attached to a 1½-in. diameter, 8-ft spruce pole. Actuating mechanism of the insulator fork is retained but forks have been replaced with padded circular jaws shaped to accommodate a 3½-in. diameter fuse.

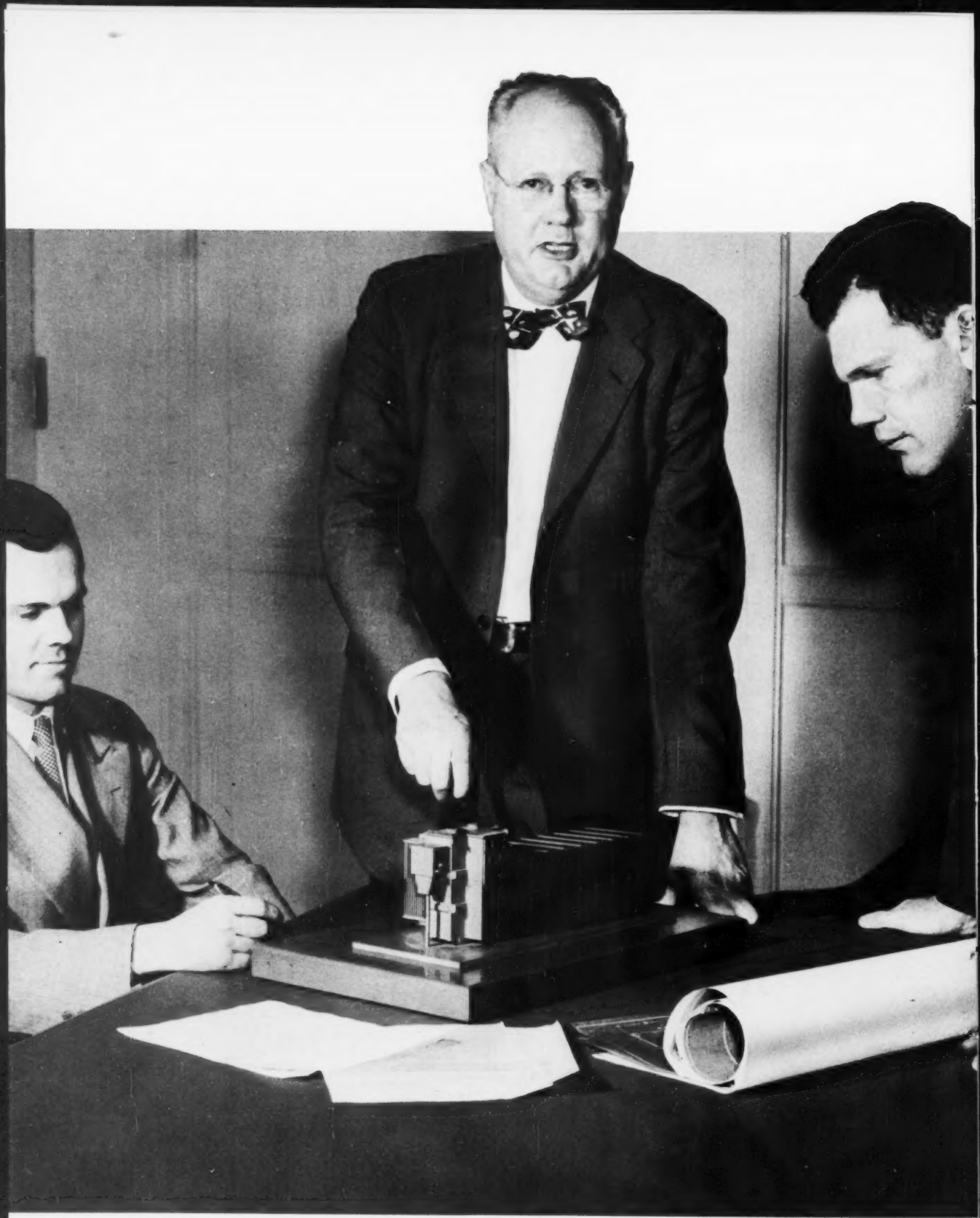
In operation, a fuse is first opened with a hook stick. The puller's clamp head is adjusted so that pole will be vertical when clamp is placed around the approximate center of fuse. When pole is turned in clockwise direction, a wedge advances in the actuating mechanism to tighten the jaws around fuse.

After fuse is lifted up and out to disengage bottom pins, it is lowered vertically into a swivel type seat. This seat facilitates laying fuse on ground for replacement of fusing element. To replace fuse, sequence of operation is reversed.

Meet F. N. McClure, Sponsor Engineer, Westinghouse Electric Utility Department. On the following 11 pages he shows how Westinghouse products are . . .

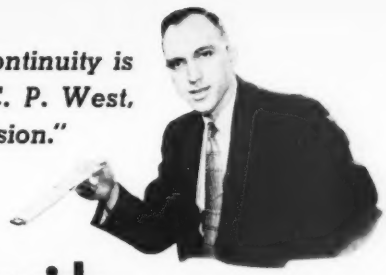
Helping you approach automatic service continuity . . . realistically

Frank McClure "sponsors" utilities in their engineering relationships with Westinghouse. As liaison with our Central District, he coordinates the engineering problems of his utilities with district and headquarters Consulting and Application Engineers. Frank has worked in all phases of utility problems including relaying, load-flow studies and Magamp development.



YOU CAN BE **SURE**...IF IT'S

"The foundation of automatic service continuity is in coordination of equipment. Here's C. P. West, Engineering Manager, Switchgear Division."



See how specialists provide the utmost in equipment coordination

When you order a Westinghouse unit substation, a whole staff of engineers goes to work on it—because we know your problem of automatic service continuity demands the utmost in coordination of transformation, regulation, relaying and switching. Years of designing and manufacturing unit substations has developed unusual proficiency in this operation.

Take the case where unit substations are connected into a primary network for a high degree of automatic service continuity. Working together, our relay, transformer and switchgear engineers have developed a complement of equipment that assures positive relay operation at low currents and associated voltage fluctuations.

This permits the use of unit substation transformers with Hipersil® cores, having low magnetizing current, without sacrifice of high performance fidelity on reverse current flow.

The critical problem of coordinating the tap-changing-under-load elements of a unit substation requires a close working arrangement between other switchgear, transformer and relay engineers. The operating and design characteristics of the tap-changing-under-load voltage regulating relay and compensating devices must be matched with those of the controlling potential and current transformers.

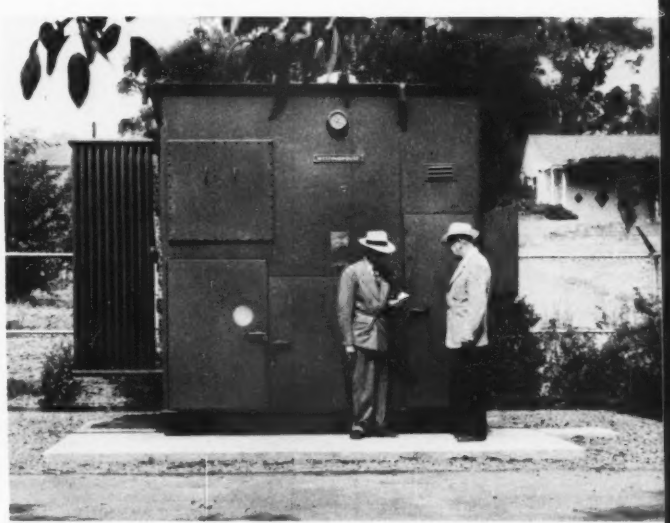
Similarly, the electrical characteristics of the tap-changing-under-load driving motor, the cooling fan and/or the cooling pump motors, and the auxiliary power required for operation of the associated circuit breakers must be matched and integrated to permit the most efficient use of the control power source. Here, too, the utmost in coordination is assured by the constant contact, within one organization, among the engineers responsible for the design of each of the components of the complete substation.

The thermal relays which protect the transformer against overloads are precisely designed and calibrated to simulate the loading of the transformer and properly operate to trip the associated breakers.

This greater assurance of complete coordination for automatic service continuity is another important factor to consider when you are planning to buy substations. Consider, also, the great flexibility of Westinghouse unit subs, the ease of installing, the ease with which new units can be added when loads grow or shift.

When you're thinking about new substations, call in Westinghouse early in your plans. And write now for informative booklet B-4061.

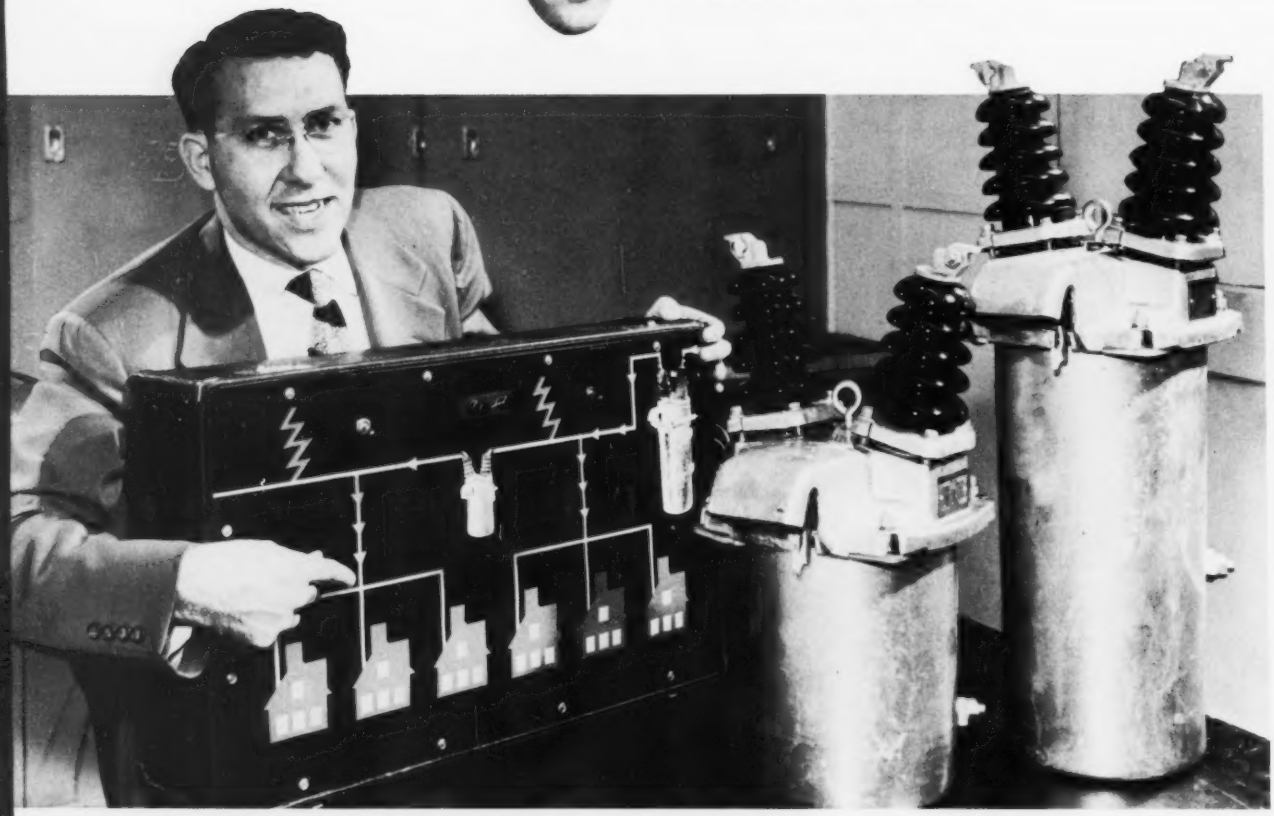
J-60835



For single-feeder service, the Westinghouse "CSP®" power transformer represents the ultimate in equipment coordination for automatic service continuity. Transformer, breakers, relays, lightning protection and tap-changing-under-load equipment are contained in one housing.

Westinghouse

"Westinghouse has studied the application of reclosers and sectionalizers, exhaustively, to provide automatic service continuity. Ken Niebauer discusses . . ."*



Automatic service continuity now practical in more rural and suburban areas

With the development of a complete line of Westinghouse low-cost reclosers and sectionalizers, it is now economically practical to extend automatic service continuity to more rural and suburban areas. Westinghouse can help you achieve the coordination required.

On many systems, reclosers are set for two instantaneous trips and two time delays to lock out. This provides for good fuse coordination because temporary faults will be cleared by the instantaneous operations, thereby saving the fuses.

This system has the disadvantage, however, of causing all the reclosers in series to trip on every fault, because it is impossible to coordinate reclosers on instantaneous tripping. This results in excessive operation of the reclosers.

Westinghouse reclosers make possible a better reclosing scheme because they can be set to trip on four time-delay operations. When a fault occurs, only the nearest recloser trips. This saves wear and tear on the others. This system works best with sectionalizers and it provides the ultimate in automatic service continuity for rural and suburban areas.

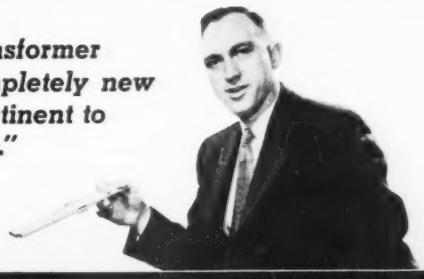
Westinghouse offers still a third scheme—one instantaneous and three time-delay trippings of reclosers. This reduces recloser operation as compared with the two instantaneous trip method and provides better fuse coordination than the four time-delay system. We would like to discuss automatic service continuity with you. Write for more data.

J-60837

*Mgr., *Fuse and Recloser Engineering.*

YOU CAN BE **SURE**...IF IT'S

"Here's Bob Ray, of the Transformer Division, to announce a completely new transformer development pertinent to automatic service continuity."*



New TX arrester triples current-clearing ability of "CSP" transformers

Three times the power-follow current interrupting capacity! That's the direct result of the new Type TX arrester now used on Westinghouse "CSP" distribution transformers. Here's how it's accomplished—

The new arrester design retains the high surge-current characteristics of previous arresters. But 60-cycle current-clearing ability is tripled by a "spiral-type" filler which stretches out the path for the 60-cycle current to effectively limit the flow of the dynamic current to less than ½ cycle. This new feature is another reason why "CSP" transformers can be installed *anywhere* on your distribution system.

The new 3-kv TX arrester is available mounted directly on the wall of the "CSP" transformer where it obtains maximum coordination with high-voltage bushings and the transformer insulation level. Higher ratings will be available shortly. Radio interference is reduced because the gap is on the line end and the arrester is not in the circuit unless discharging.

If you want realistic automatic service continuity at all points along your distribution system, make certain you investigate "CSP" transformers with the new TX arrester. Your nearby Westinghouse representative will be glad to supply full details.

J-70699

*Mgr., *Distribution Transformer Sales.*

Westinghouse

YOU CAN BE **SURE**...IF IT'S

"Mike Meixner, Manager, Regulator Sales, discusses a significant factor in obtaining automatic service continuity at the right voltage—"

Simplified "all-electric" regulation assures accuracy in automatic service continuity

The dependable accuracy of voltage regulation is one of the necessary factors in the approach of realistic automatic service continuity. This accuracy should be attained with simplified controls that are easy to adjust and maintain.

Westinghouse has provided the answer to this important consideration with the new all-electric control panel like the one shown. Here's how—

All moving relay parts are spring-hinged—eliminating troublesome mechanical bearings and possible friction drag. Metallic contact of the pole faces on the motor-operating relays has been eliminated through spring-supported, snap-action elements. It is impossible for the relays to stick because of residual magnetism. Contacts are heavy-duty silver, designed to last the life of the unit.

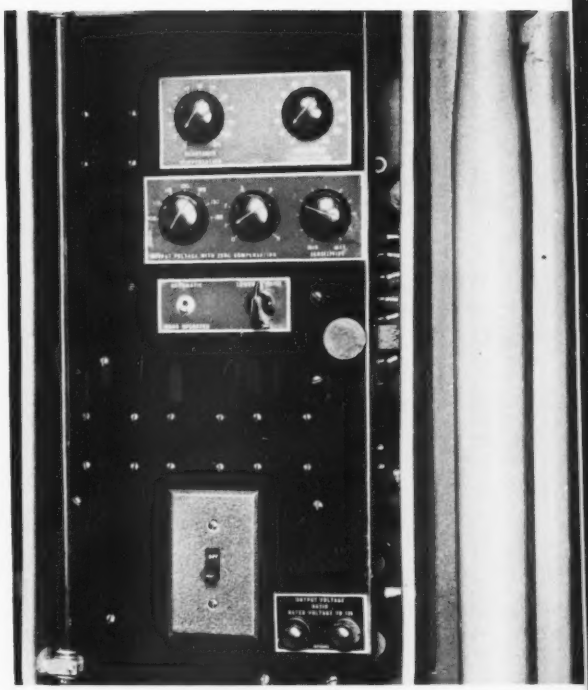
And, in addition, they're easy to operate. Your men can operate the Westinghouse all-electric control panel without complicated mechanical adjustments. No tools are necessary because pin-point accuracy is obtained by simply turning three knobs—all located for convenient accessibility on the front of the panel. The result is the smoothest possible regulation, with simplified, sensitive control.

All-electric control panels are typical of the outstanding design advantages found in Westinghouse regulators. Whether your requirement is in the low, medium or high range of voltages—you will find a Westinghouse regulator designed to meet your specific need.

When you're confronted with the problem of attaining a realistic pattern of automatic service continuity with accuracy of voltage level—remember to investigate Westinghouse regulators. Your Westinghouse representative is ready to serve you. And in the meantime, write for D.B. 47-310.

J-10406

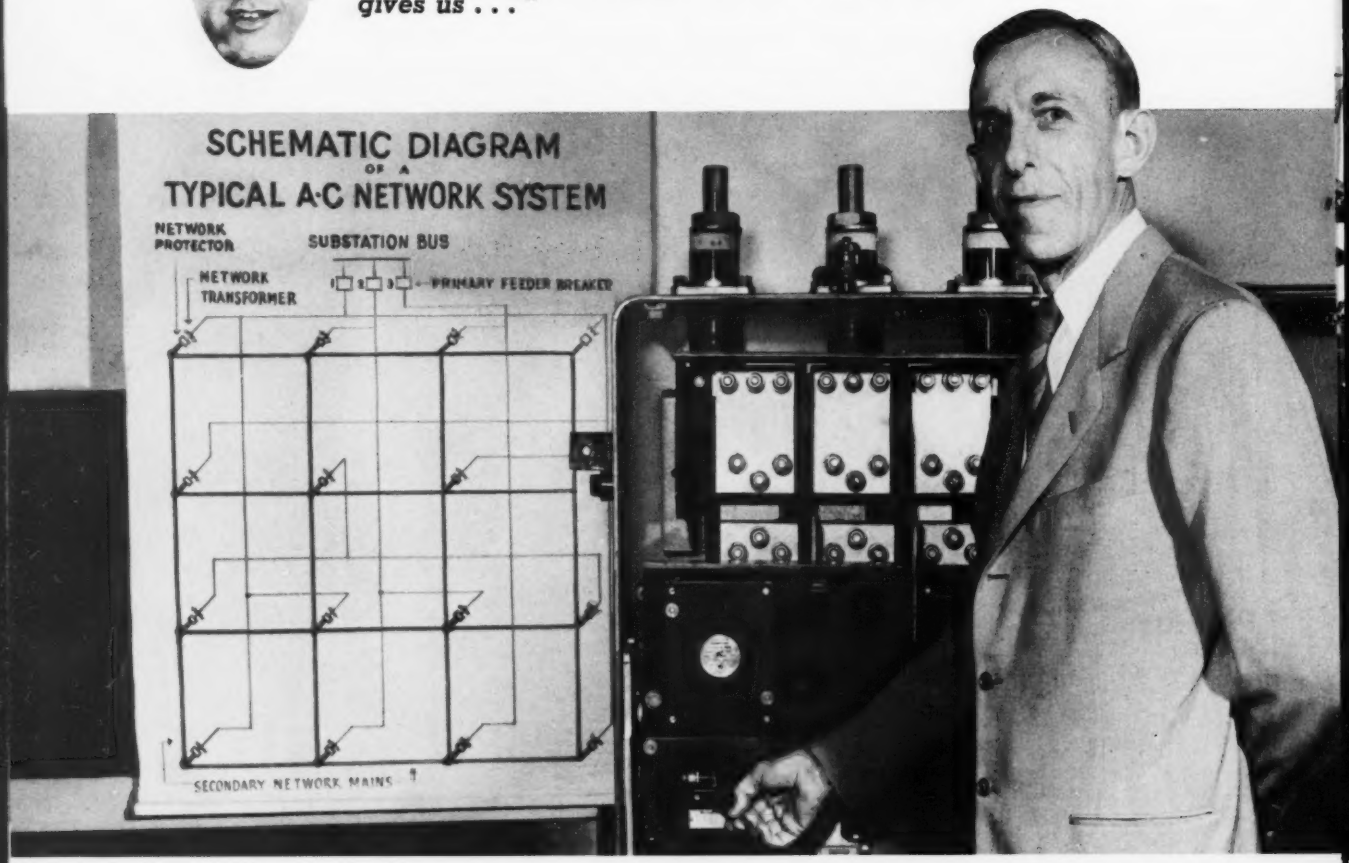
Westinghouse



All-Electric Control Panel. This close-up demonstrates the unusual simplicity of operation. Clearly calibrated voltage markings make it possible for any operator to make exact adjustments without the use of tools.

Voltage Regulating Relay completely eliminates mechanical adjustments. All settings are made by adjusting the knobs on the control panel. All moving parts in the relay are spring-hinged to eliminate mechanical bearings.

"Automatic service continuity is epitomized in the secondary network. George Grissinger, Manager of Network Protector Engineering gives us . . ."



Facts behind the exceptional service continuity of Westinghouse secondary networks

The ultimate in automatic service continuity is the a-c secondary network system . . . made possible by the network protector, an exceptional device pioneered by Westinghouse 30 years ago.

Network relays are the "intelligence" of each protector. The CN-33 master relay trips the protector automatically on reverse power flow (power flow from the network to the network feeder). The master relay and CNJ phasing relay automatically allow the protector to close if the power flow will be correct (power flow from the network feeder to the network).

Because network operation requires sensitive relays, Westinghouse has made relay adjustments easy to understand and easy to make. All adjustments can be made from the front of the relays without removing them from the protectors. Reverse current adjustments of 0.1% to as high as 10% of the rated protector current are obtainable on the master relay.

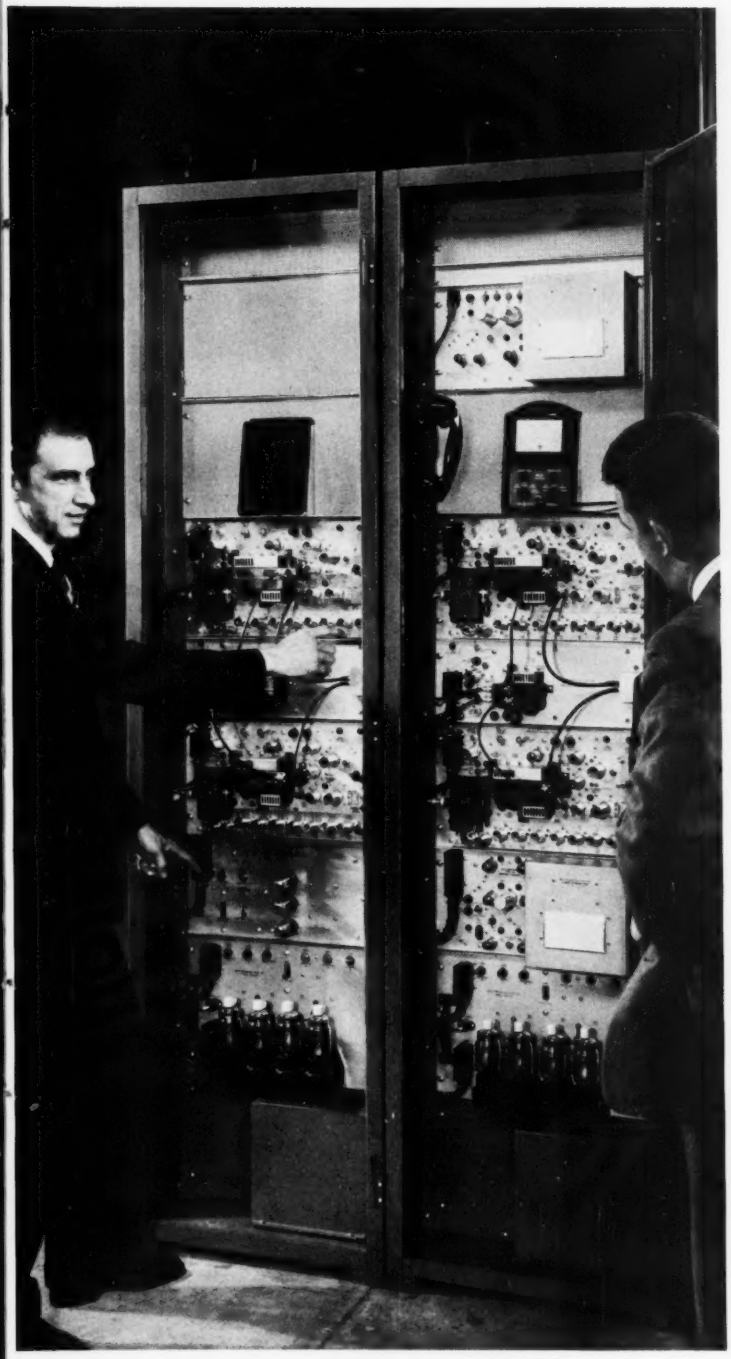
The sturdy construction, unusually high torque and unmatched performance of Westinghouse network relays insure network service continuity. "Deion®" arc interruption gives fast and reliable clearing of system disturbances.

Get more information on this outstanding equipment which is so important to network operation. Write for Descriptive Bulletin 35-550 describing the operation of Westinghouse network protectors.

J-60836

YOU CAN BE **SURE**...IF IT'S

"Dependable communications and control are vital to service continuity and Carl Suhrstedt tells how . . ."*



Two important factors make this microwave more reliable

This is the Westinghouse 2,000 MC microwave with up to 30 voice or 450 telegraphic channels. The reliability of these channels is protected in two important ways.

First, the multiplexing equipment, of the frequency division type, functions on the principle of distinct channel independence. If one channel develops a fault, all the other channels continue to operate without interruption. This long-term dependability of Westinghouse multiplex equipment is your greatest guarantee of reliable communications . . . for voice, supervisory control, telemetering, relaying and other functions.

As a second means of assuring service continuity, Westinghouse microwave offers stand-by radio equipment. When this equipment is used, it is automatically switched into the system if any fault develops in the radio equipment. It can be arranged for instantaneous or delayed switch-over.

When you are planning new or expanded communications and control, examine all of the specific benefits of Westinghouse microwave. The design is based expressly on utility needs and is derived from years of practical experience in microwave communications. Remember that Westinghouse makes both power-line carrier and end-use equipment so we are in an ideal position to discuss your needs without bias.

For more data, call your Westinghouse representative or write for booklet B-5850, Westinghouse 2,000 MC Microwave for Electric Utilities.

**Mr. Suhrstedt is Manager of Carrier-Microwave Application Engineering, Electronics Division.*

Westinghouse

"High-speed breaker reclosing is basic to automatic service continuity. Relay Application Engineer R. G. Lakin tells you about improvements in the RC reclosing relay . . ."

New preclosed relay contacts cut reclosure time 3 cycles

Now Westinghouse has achieved truly instantaneous reclosure of electrically operated circuit breakers with improvements in the RC reclosing relay. This high-speed action was made possible by the design of new *preclosed* contacts. Now it is possible to save the three cycles formerly required to energize and close a set of contacts.

When a fault occurs, overcurrent or other protective relays on the line open the breakers and energize the RC relay. Since the reclosing contacts in the RC relay are *already* closed, the RC relay acts instantly to close the breakers. The time saved is invaluable in saving important loads.

If a fault still exists after the instantaneous first reclosure of the RC relay, the equipment will make additional reclosures at suitably timed intervals. If the breaker does not remain closed after the final reclosure, it is locked out until the fault can be corrected.

Another feature provided by the redesigned RC relay is lockout of the instantaneous element in protective relays used with the RC relay. This is essential, for example, when fuses are used to protect branches of a main feeder. If a fault on a branch feeder does not clear with the first trip-out, the RC relay will lock out the instantaneous element in the protective relay, allowing the fuse to clear the fault on the next reclosure.

For more information on the RC reclosing relay, write for D.B. 41-310. J-40451

YOU CAN BE **SURE**...IF IT'S

"Bob McCollom, Transformer Application Engineering Manager, points out an exclusive feature in transformer manufacturing."

QC* impulse testing . . . exclusive proof of instrument transformer reliability

Automatic service continuity on a realistic basis is largely dependent upon instrument transformers—vital "links" between your lines and their controls. Not only must they meet accuracy standards but they must be absolutely dependable, as well.

That's why Westinghouse and only Westinghouse offers this proof. Simulating both normal and abnormal conditions they might be subjected to in service, Westinghouse surge tests instrument transformers on the production line.

This quality control testing assures that the required impulse strength has been built into the transformer—before it leaves the plant—and before service continuity can be effected.

And, as added measure of reliability, other features like Hipersil cores, oxygen-free copper, plastic impregnation and oil-vacuum processing make Westinghouse instrument transformers the most reliable and accurate transformers on the market.

When you're looking for a realistic approach to automatic service continuity, get full details on Westinghouse instrument transformers. Your local Westinghouse representative will be glad to cooperate. Call him today.

J-70698

*Quality Control.

Westinghouse

"Constant product improvement is the key to better service continuity, and . . ."

The realistic approach to automatic service continuity starts here

Last year Westinghouse spent more money to improve products than was earned in net income. Some recent relay developments illustrate how these dollars contribute to service continuity and other utility problems. Take the RC relay, which automatically recloses circuit breakers. A new set of contacts has been added which enables the RC to do the work of *two* relays. These contacts can lock out the protective relays after the initial opening—until reclosing is completed. Previously this required separate auxiliary relays. Result: automatic service continuity is simplified.

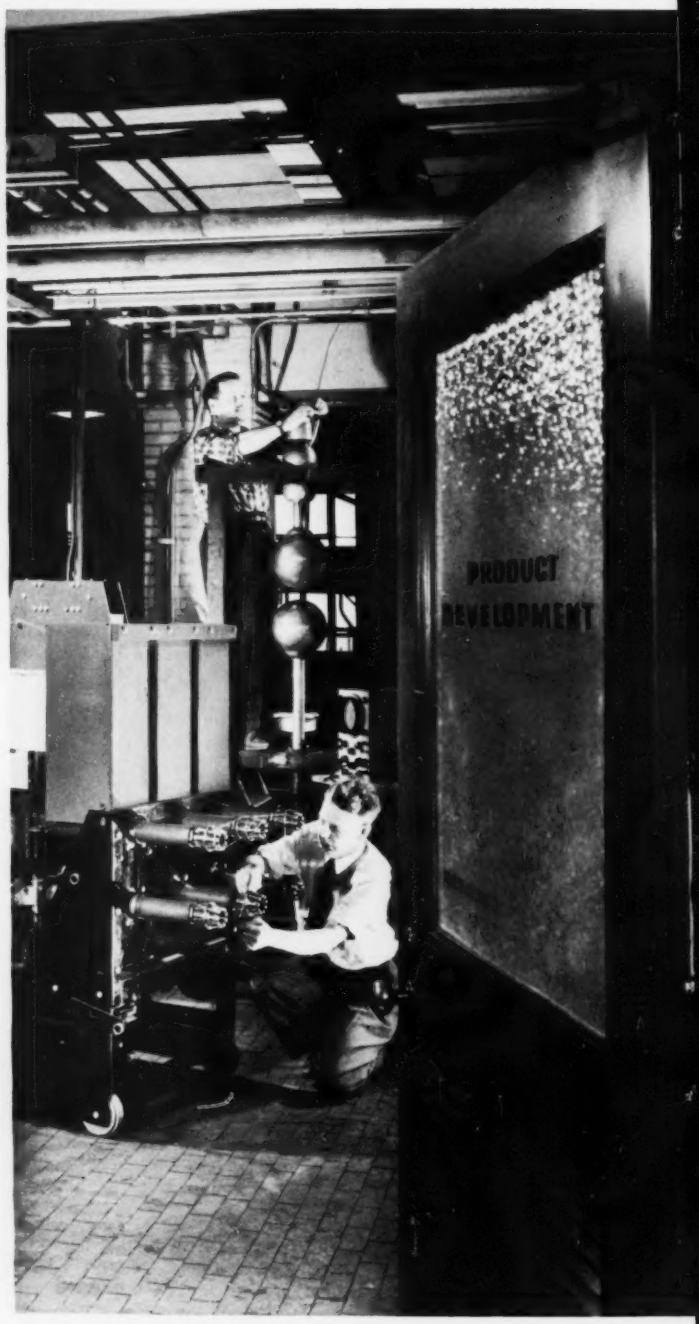
Ground relays that operate due to directional overcurrent have heretofore been polarized either by voltage or current. We made two kinds, and utilities stocked two kinds. Now we have developed the new HCRD relay which is polarized by *either* voltage *or* current, or both, eliminating stocking problems.

A major development, last year, was the introduction of the new Westinghouse overcurrent relay . . . the ultimate in accuracy, flexibility and reliability. Moreover, the new CO relay can be calibrated for inverse or very inverse time-current characteristics. This formerly required separate relays.

Westinghouse has over 200 individual laboratories making improvements like these. More are being built, including the $6,000,000 turbine laboratory at South Philadelphia, a new turbine-generator test floor at East Pittsburgh, an ultramodern research laboratory with constant expansion in the existing facilities. CP-1009

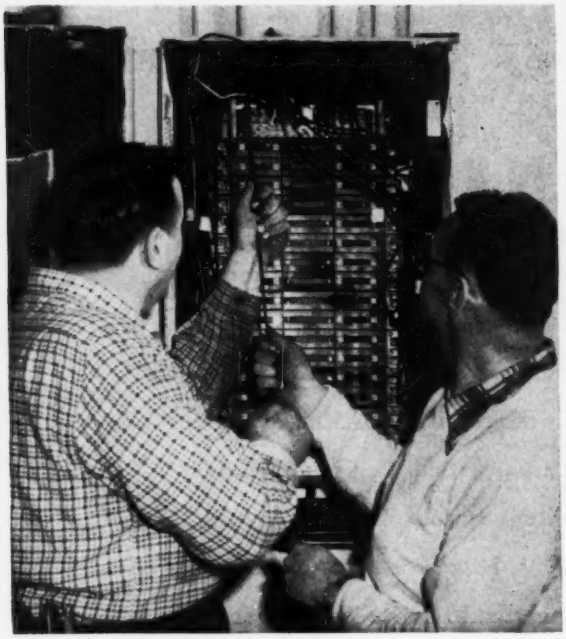
• • •

For more information on the products described on previous pages, write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



YOU CAN BE SURE... IF IT'S

Westinghouse



1 ELECTRICIANS PUSH STEEL FISH (having small cobalt disc on end) into 2-in. conduit at panel box alongside wires in conduit

2 GIEGER COUNTER FOLLOWS course of cobalt disc in conduit. Chief C. K. Helton and author use counter on floor above conduit

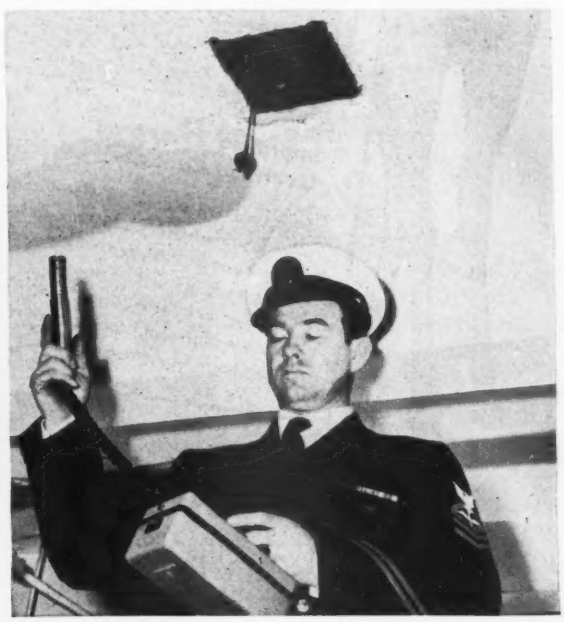
Geiger Counter Locates Hidden Pull Box

F. H. MacGINNIS, Industrial Sales Representative, Niagara Mohawk Power Corp, Buffalo, N. Y.

The use of a Geiger Counter made it possible to locate in 20 min, a pull box which was buried in a concrete and gypsum ceiling at the Edwards Properties Inc. building, Buffalo, N. Y. Although this is a rather unusual way to use a Geiger Counter, it saved electricians of the Robertson Electric Construction Co a great deal of time in

(*Continued on page* 172)

3 FOLLOWING COURSE of cobalt disc in conduit from scaffold in basement after running into obstructions on floor above



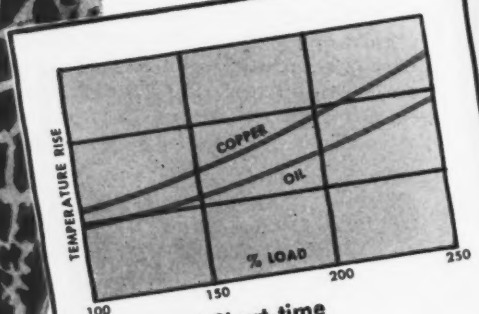
4 PULL BOX LOCATED after only 20-min. Picture shows box cover removed and cobalt disc on end of protruding fish wire

. . . for High

MOLONEY HiperCore

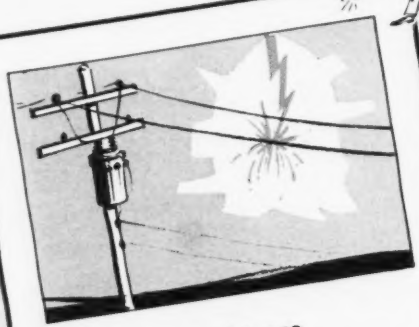
Today's demands upon utility distribution systems necessitate transformers engineered to withstand severe operating conditions. All around efficient system performance is the result when Moloney HiperCore Transformers are installed. Engineered and designed to withstand today's excessive load demands on utility systems, HiperCore Transformers perform better, last longer and require less maintenance.

ME53-16



Improved Short-time Overload Capacity

Improved short-time overload characteristics provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of windings and lower hottest-spot temperature gradient.



High Surge Resistance

Moloney HiperCore Transformers are designed to withstand lightning surges well in excess of the minimum requirements. A high factor of safety in properly distributed insulation and vacuum processing produce the ultimate in overall dielectric strength.

MOLONEY ELECTRIC

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS

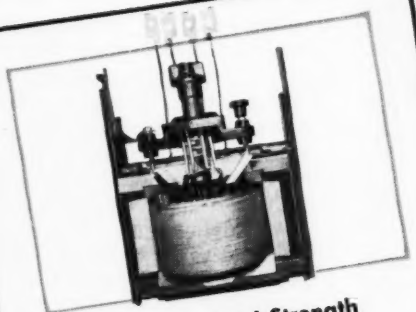
System Efficiency

DISTRIBUTION TRANSFORMERS

MOLONEY ELECTRIC COMPANY

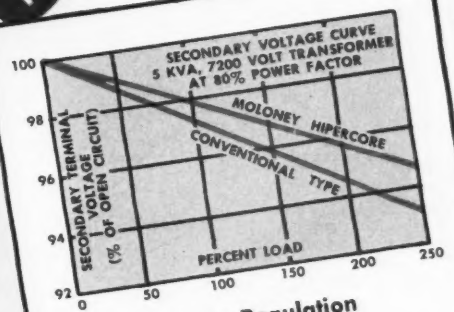
Step Voltage Regulators • Unit Substations

MISSOURI AND TORONTO, ONT., CANADA



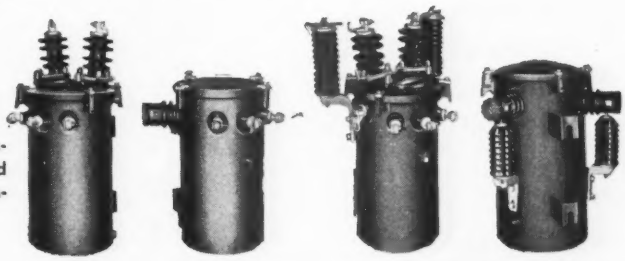
Greater Mechanical Strength Against Short Circuit Forces

Coils are made mechanically rigid through the use of heat curing bonding material. The coils are blocked solidly by the impregnated core which is in turn banded with tons of force, providing maximum strength against short circuit forces.



Better Voltage Regulation

The smaller cores of HiperCore Transformers make possible windings having lower impedance. Lower impedance provides lower internal voltage drop at all loads. This is especially important during peak load periods, since HiperCore Transformers can carry higher overloads than older types, at the same permissible regulation.



Moloney HiperCore Distribution Transformers are available in all standard ratings from 3 Kva up in both Conventional and CSP designs.

MOLONEY ELECTRIC = { BETTER PERFORMANCE, GREATER RELIABILITY, LESS MAINTENANCE

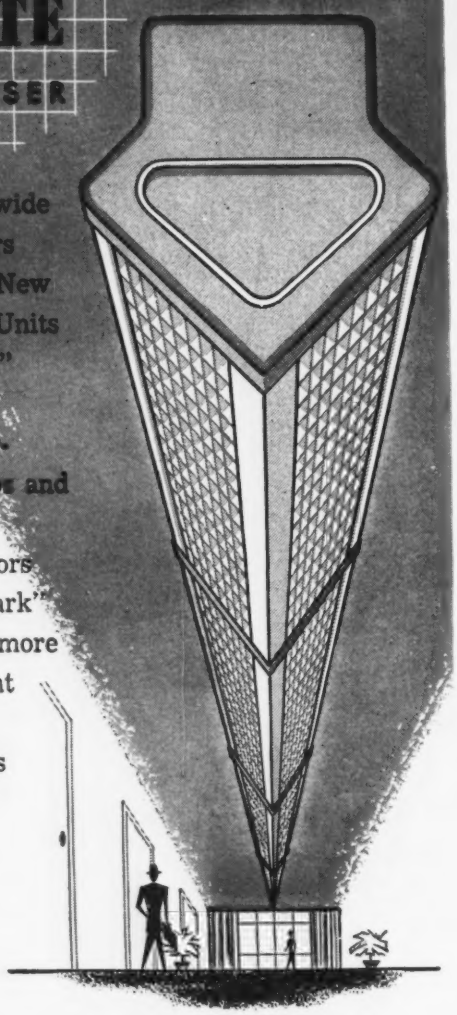
make hallways say, "Come in!"

new Guth V·C·U

"V" CORRIDOR UNIT

with GRATELITE* LOUVER-DIFFUSER

At last—you can fill wide hallways and corridors with practical light! New Guth "V" Corridor Units provide "wall-to-wall" illumination. The GRATELITE Louver-Diffuser shields lamps and is easily maintained. Hallways and corridors "come out of the dark" and turn into safer, more cheerful lines of light that guide the eyes and the step. V·C·U's available in 4′ & 8′, 1 & 2 light models.



*Patents Pending
Trademark Registered

Write today on your letterhead for complete information.

Guth

THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.

Geiger Counter

(*Continued from page* 169)

locating the box. It was some 15 ft from a panel box and there was no way of determining which direction the conduit ell took after leaving the box.

In constructing this building a number of years ago, conduits and pull boxes were poured into the concrete construction. After the wires were pulled in, the surfaces were covered with approximately one inch of gypsum plaster. As the electrical plans used in the construction of this building have been lost, there was no way of telling where these conduits led to or where the pull boxes were located.

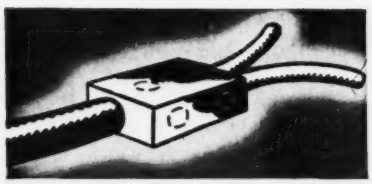
The electricians requested that our company loan them a mine detector so that they could attempt to locate the pull box. They knew that by inserting a steel fish into the steel conduit, they could go about 75 ft before it was stopped by an obstruction. This conduit contained three—two wire circuits. These old wires had to be removed in order to pull in new wiring to take care of a new lighting job which was being installed.

We informed the electricians that a mine detector would not work as there was too much steel in the construction of the building. Mr. Carl Helton, Aviation Devices Chief of the U. S. Naval Air Station at Niagara Falls, who was standing by at the time, offered his services to locate this pull box with a Geiger Counter.

The following morning Chief Helton arrived at Edwards Properties building with two seaman from the base, bringing with him the Geiger Counter and a piece of cobalt #60, 1 in. in diameter and ¼ in. thick. Opening the hook on the end of the steel fish, the cobalt was inserted between the hook and taped fast with electrician's plastic tape.

The electricians forced the tape containing the cobalt into the 2-in. duct alongside of the conductors already there and when they reached the ceiling Chief Helton informed them to proceed 3 ft at a time. Then he and myself proceeded to the floor above and located the effects of the cobalt with the Geiger Counter on the floor. He had stationed one of the seaman at the head of the stairs and the other one at the foot of the stairs to the basement—signalling to the seaman to proceed another 3 ft

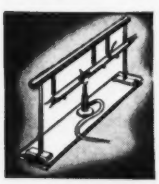
How to get longer life out of your portable cords and cables!



1 USE junction or distribution boxes for making multiple power connections in working places.

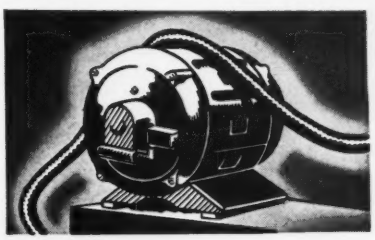
2 PROTECT cables with fuses or circuit breakers of the proper rating for the service. Make sure that circuit breakers will operate properly.

3 PROTECT cables from being run over by heavy equipment. Running over the cable a few times may not cause immediate failure, but may do internal damage which will shorten its life. If the cable must be run across an aisle, place boards on either side as one would for a hose. If it is in use for only a short time, it should be thrown over the truck.

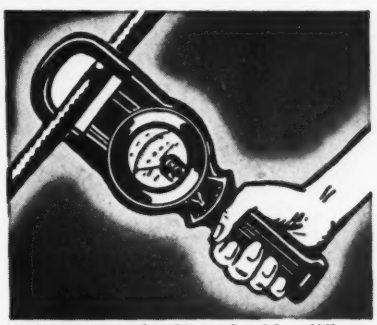


4 USE flame-resistant cables wherever possible.

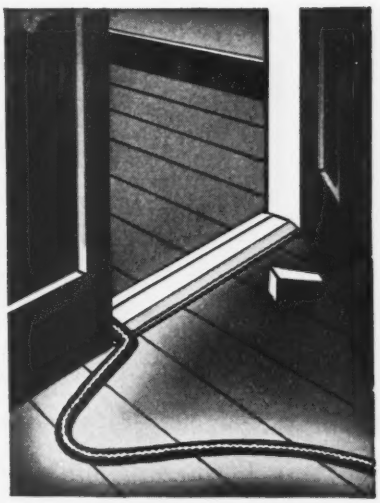
5 DO NOT have portable cords and cables running over steam pipes or other heat-transmitting equipment.



6 KEEP cables away from sparking motors and high voltage equipment. The ozone generated by sparking commutators attacks rubber jackets, causing cracking.



7 AVOID overloading of cables. Where possible, use I.P.C.E.A. recommended current ratings.



8 AVOID dragging portable cords around rough edges or sharp corners. Bruises and cuts hasten deterioration of the jacket. Never yank cords to remove kinks or loosen them when caught on a projection.

9 AVOID running portable cables on pulleys or drums too small for the size of the cable; observe recommended I.P.C.E.A. minimum diameters.

10 KEEP cords away from oils and greases. If they do get into oil, they should be wiped off as soon as possible. Avoid having cords lie in pools of water, chemicals or grease.

11 BUY cables that can carry the required current without overloading or overheating. They should be flexible (have sufficiently fine strands) for the intended use.

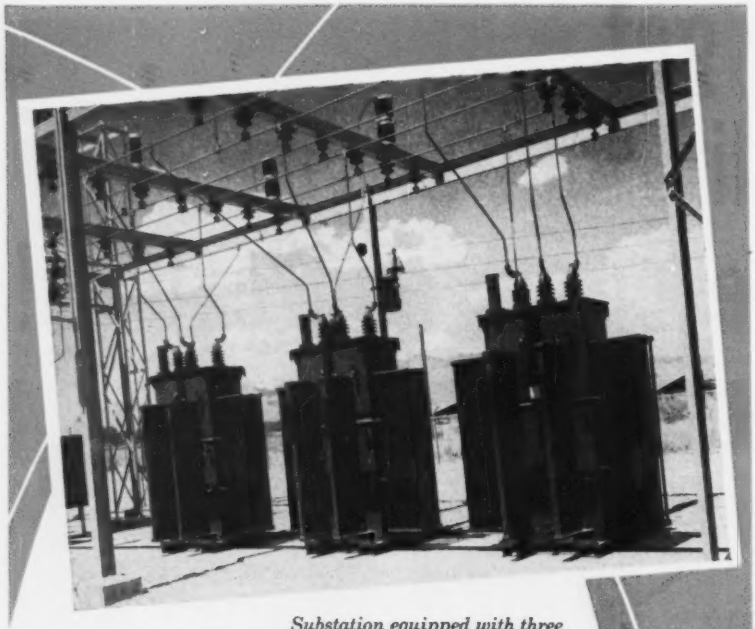
FOR FREE REPRINTS OF THIS PAGE, WRITE TO ADDRESS BELOW.

UNITED STATES RUBBER COMPANY

U.S.RUBBER
SERVING THROUGH SCIENCE

Electrical Wire and Cable Department

ROCKEFELLER CENTER • NEW YORK 20, NEW YORK



Substation equipped with three 1250 KVA single-phase Stockwell transformers.

EVERY STOCKWELL TRANSFORMER is the result of specialized research and sound design. Rigidly controlled materials and modern production facilities are additional guarantees of the quality of our products.

Our field organization and our staff of application engineers at Akron will be glad to help you on all your transformer and substation problems.

STOCKWELL

TRANSFORMERS

DESIGNED FOR YOUR REQUIREMENTS

STOCKWELL TRANSFORMER CORP.

AKRON, OHIO

OIL-FILLED, DRY TYPE, and ASKAREL-FILLED DISTRIBUTION AND POWER TRANSFORMERS

each time we located a spot.

In this way, proceeding 3 ft at a time and marking the floor each time, we finally reached a position on the floor where a partition prohibited our going any further. We returned to the basement and the Chief mounted a scaffold and again located the position of the cobalt against the ceiling. Going about 15 ft further we reached a point where the fish would not go any further. The electricians chiseled in at this point on the ceiling and located the cover of the box.

Ordinarily, pull box covers are left exposed so that they can be accessible, but in this case the box had been completely buried. Since this is the first experience we have ever had in trying to locate such a pull box, I know of no other method which could be employed, other than tapping holes in the ceiling at intervals in order to find it. This would be a costly and time consuming procedure.

INDUSTRIAL BRIEFS

Brazing beater blades for portable mixers at Hunter Spring Co, Lansdale, Pa. with a 20-kw induction heater replaced riveted assembly and cut production costs $2.25 per hr. The product has been improved and rejects virtually eliminated. Six blade assemblies are brazed in a jig in 23¼ sec for two operations per blade, or a production of 225 blades per hr.

Heating preforms by 3-kw dielectric units reduces processing time 70% in making phenolic and rubber plugs and receptacles at Albert & J. M. Anderson Mfg Co, Boston, Mass. Unskilled operators need only place the blanks on the electrodes, close cover, press start button and job is finished. Cover opens automatically when preheating is completed.

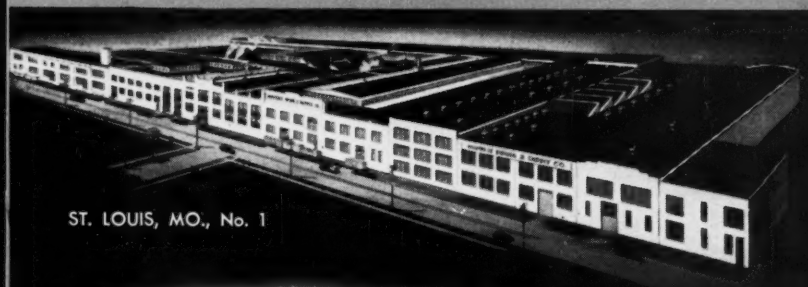
Metal melting for linotype machines at the Savannah Morning News and Savannah Evening Press, Savannah, Ga., has been changed over from gas to electric with a noticeable improvement in working conditions. Temperatures have dropped and bothersome pipes on the floor have been eliminated. Automatic electric slug making machines which need hardly any attention have also been installed. Total added load from this change over is over 50 kw. C. D. Anderson,

Users of Piping

whether a simple bend *welded assembly* *or*

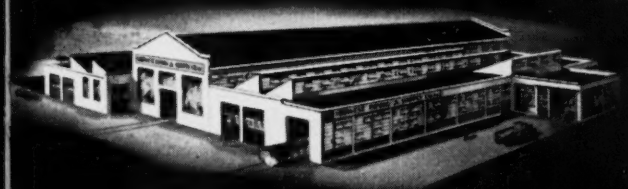
complete piping systems for power plant *or process*

get Multiple Advantages from MIDWEST Multiple Plants

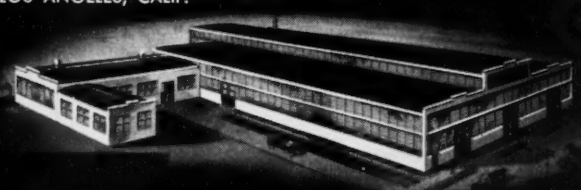


ST. LOUIS, MO., No. 1

ST. LOUIS, MO., No. 2



LOS ANGELES, CALIF.



PASSAIC, N. J.

BOSTON, MASS.

Strategically located multiple plants and large scale operations have made it economically practicable for Midwest to develop much special pipe fabricating machinery and to conduct piping research that would be impossible under other circumstances. Multiple plants create a friendly rivalry between the organizations of these plants that advances the art of piping fabrication more rapidly than would otherwise occur. All these activities are reflected in better fabricated piping . . . in greater piping value per dollar. • Multiple plants help make Midwest the preferred source for prefabricated piping. 4909

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices: New York 7—50 Church St.
Los Angeles 33—320 Anderson St.
Boston 27—426 First St.
Chicago 3—79 West Monroe St.
Tulsa 3—224 Wright Bldg.
Houston 2—1213 Capitol Ave.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS

SHAWMUT'S NEW FORM 208 Amp-trap®

SAVES BOTH CIRCUIT AND CUSTOMER
(FOR 120/208 VOLT AC OR 125/250 VOLT DC NETWORKS)

POSITIVE PROTECTION AGAINST SUPERCURRENTS

Low voltage AC and DC networks give large utilities and their customers greater continuity of service and easy expansion of their systems. The only drawback to this type of network is the constant threat of danger from heavy short-circuit or fault currents. Shawmut's new FORM 208 Amp-trap eliminates this danger from these circuits. On actual test, its amazingly fast "chop-off" stops a short-circuit *even before it reaches the peak of its first ¼ cycle — even if the available peak current could reach* 560,000 *Amps!* It anticipates and prevents the destructive build-up of heavy fault currents so dangerous to office buildings, stores, hospitals, theatres, schools, etc. FORM 208 saves *both* circuit and customers.

USES & SPECIFICATIONS

Amp-trap FORM 208 is made for Entrance Switch Service, Underground Network Conductors, Distribution & Panelboards and other applications. It is built in Ampere ratings of 1000, 1200, 1600, 2000, 2500, 3000, 4000 and 5000 for Entrance Switch Service and for cable sizes from 4/0 to 1000 MCM. It runs "cool" and carries 100% of its rating with temperature rises less than those recommended in the Underwriters' Laboratories Standards for Fuses. The watt (power) loss is probably lower than for *any other over-current protective device*. Hence it may safely be installed in vaults and steel enclosures and subjected to long continued loads.

LOW IN COST — EASY TO INSTALL

FORM 208 Amp-traps clear fault currents long before they can burn or wreck bus bars and switch gear. Yet they are small in size, low in cost and easy to apply. They have a variety of mountings for flat, bus or tubular connectors. Adapters can be supplied for switch cubicles now equipped with copper or aluminum alloy links. FORM 208 is the "little brother" of the famous FORM 600 Amp-trap which has long been used so successfully on 600 volt circuits. Write today and find out about FORM 208 at once.

208
WITH TUBULAR TERMINALS

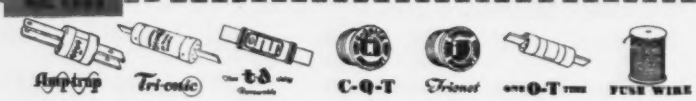
Copyright 1953 The Chase-Shawmut Co.

OUR 60 IN YEARS — FROM EDISON TO ELECTRONICS

208 AMP-TRAP — "Awake At The Switch"

THE CHASE-SHAWMUT CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS



Power Sales Engineer, Savannah Electric Power Co.

Raising power factor by addition of 45 kva in 240-v, 3-phase capacitors at Herschede Hall Clock Co, Cincinnati, Ohio also released enough transformer and feeder capacity to permit addition of 10 kva of new load and improved voltage on bus duct feeder. Present 300-kva, 4160/240-v, 3-phase transformer bank was loaded to capacity and space would not permit larger transformers. Power factor was only 50%. Part of capacitors are installed at terminals of an air compressor motor which operates almost continuously. Remaining capacitors are installed at ends of bus duct feeders which were heavily overloaded. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

Heating water to prevent freezing during wintry weekends in cooling tower on roof of textile manufacturing plant of Powdrell & Alexander, Danielson, Conn., is accomplished by two 2-kw immersion heaters and 30 ft of heating cable wrapped around piping and pump, both of which are insulated. Tank capacity is 50 gal. Thermostatic control cuts in heaters at about 35 F and pilot lamps in plant show when heaters are in operation. Connecticut Light & Power Co.

Melting aluminum ingots and keeping molten metal at uniform temperature with a 40-kw, 60-cycle induction melting furnace at Herschede Hall Clock Co, Cincinnati, Ohio provides uniform quality of castings. Furnace generates heat in the aluminum without danger of overheating the surface. A 45-kva bank, composed of 6- 7½-kva, 240-v, single phase capacitors, is mounted in the contactor cubicle to correct power factor of induction load. Temperature of molten aluminum is automatically maintained at any predetermined value. This is usually around 1200 F. A percentage timer, which operates on a 1-min cycle can be set for any given percentage of time that power is on and off. During actual production, timer is set for power on 95% of the time and off 5%. When not in production, timer is set for power on 55% of the time and off 45%. Power, is turned on only during those 1-min cycles that pyrometer calls for more heat. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

Victor No. 9 Pintypes undergoing routine electrical flashover, visual inspection, and final check for pinhole thread accuracy.

VICTOR PINTYPE INSULATORS

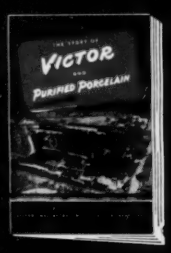
Must Pass Three Tests!

1. **ROUTINE ELECTRICAL FLASHOVER**
   Every Victor pintype undergoes a routine electrical flashover test before shipment to insure trouble-free service.
2. **ACCURATE PINHOLE GAGING**
   Every lot of Victor Pintypes must be able to pass the standard NEMA test for pinhole thread accuracy.
3. **CAREFUL VISUAL INSPECTION**
   The finished insulator is thoroughly inspected for general appearance with special attention to smoothness of conductor and tie-wire grooves.

These tests assure almost unheard-of uniformity of service . . . unequalled ease of installation of pintypes. These features, coupled with the greater hardness, strength and resistance to impact of Victor *Purified Porcelain*, make Victor Pintypes the power man's best buy.

VICTOR NO. 9
LOW VOLTAGE
PINTYPE

FREE BOOKLET gives you the full story on how Victor Insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

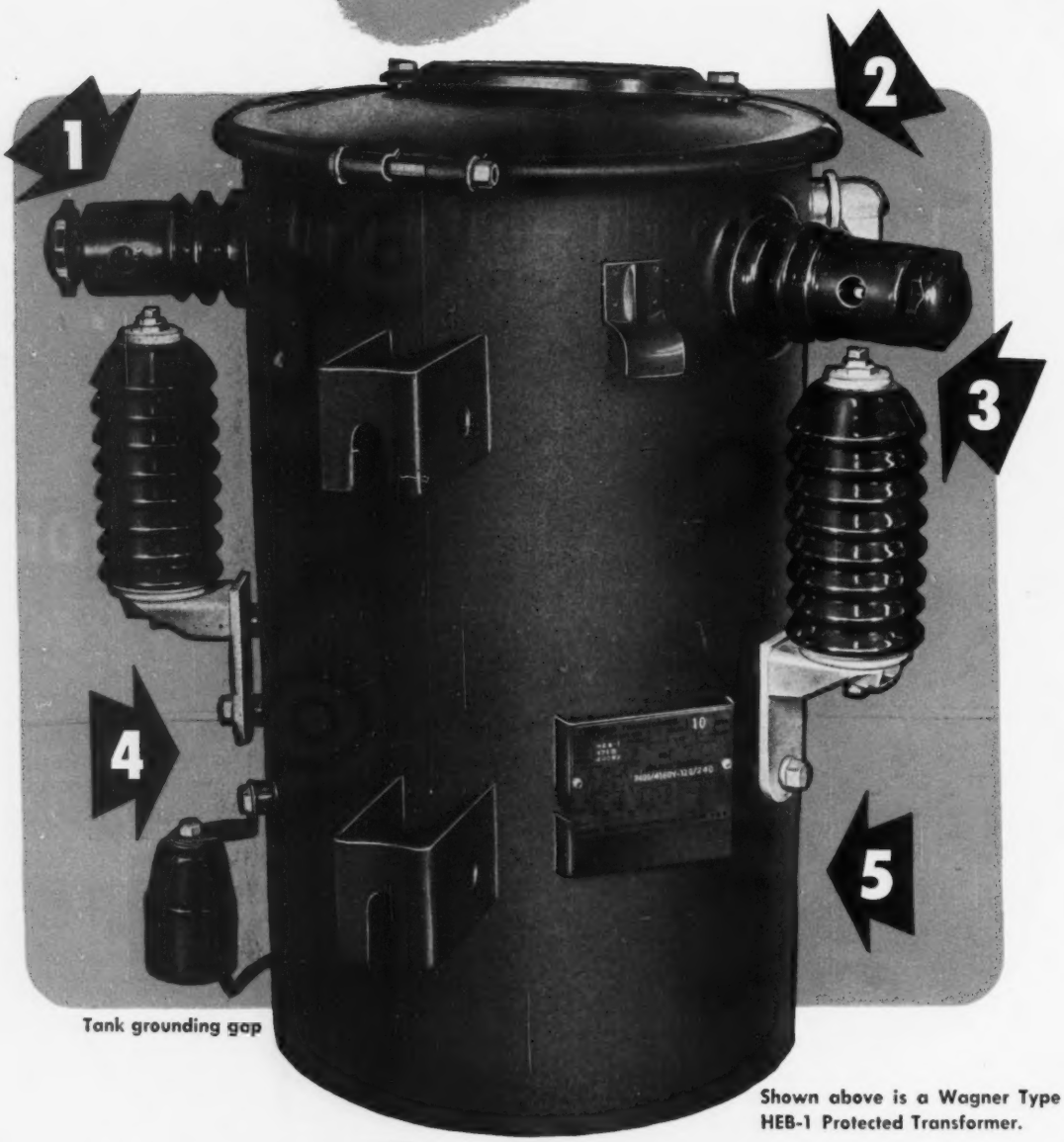


Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

these 5 important



Shown above is a Wagner Type HEB-1 Protected Transformer.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-2

advantages are yours

with Wagner Form W

Distribution Transformers

1 HIGH VOLTAGE SIDEWALL BUSHING

This high voltage bushing gives you *faster, easier, safer* permanent connections. Conductor is just pushed into the connector—no special tools are needed—and connector is tightened with a few turns of the insulated finger-grip knob.

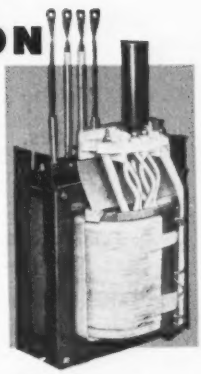
2 SHUR-SEAL COVER

You get true sealed-tank construction with covers sealed to the tank with the Wagner SHUR-SEAL Clamping Ring. "Breathing" is completely prevented—no oil can be lost during shipment or handling.

3 PRE-SET LINE TO ARRESTER ISOLATING GAP

You can get a bushing and arrester assembly that occupies minimum tank space and gives easier, safer, permanent transformer connections with arresters isolated from the line.

4 FORM W CONSTRUCTION



You get the advantage of preformed cores of cold rolled, oriented grain steel that permits a liberal design in small size, lightweight transformers that give excellent electrical performance. Form W Transformers pay dividends in longer service life.

5 INHIBITED OIL

You get extra years of service-free transformer life because Wagner distribution transformers are filled with an inhibited oil to reduce oxidation to a minimum and retard the formation of acids and sludge.

* * *

When you choose Wagner Transformers—you get all these important advantages. And in addition—Wagner has a nationwide organization to provide fast, convenient service, with branches in 32 principal cities. Bulletin TU-180 gives complete information on Wagner Distribution Transformers.

All Wagner Distribution Transformers are Standardized to meet your requirements

Wagner's complete line of distribution transformers includes every rating and design listed in the E.E.I.-NEMA Fifth Report! This means that you get the benefit of the improved design, quality construction and high efficiency of Wagner Transformers with *standardized* mechanical features in ratings of 500 kva and below.

PHASES in the growth of the electrical industry are represented by "acts of magic" presented during the evening shows

Montana Power Co Puts a Premium on Rural Sales

Utility offers $73,000 worth of coupons toward purchase of appliances. Drive also creates customer good will and dealer cooperation

D. J. McGONIGLE, General Sales Manager, Montana Power Co, Butte

Montana Power Co is creating additional load in rural areas through a promotional effort featured by $73,000 worth of coupons toward the purchase of electrical appliances and the "Room of Amazement" travelling road show. Secondary objectives of its 1953 Rural Sales Campaign include increased customer good will and development of better cooperation with the appliance distributors and retail dealers.

Campaign began on May 1 and will run to Nov. 30 to cover 57 communities in the company service area. About 12,500 rural-residential customers will be offered coupons worth from $10 to $25 toward purchase of electric water systems, ranges, water heaters, freezers, and clothes dryers.

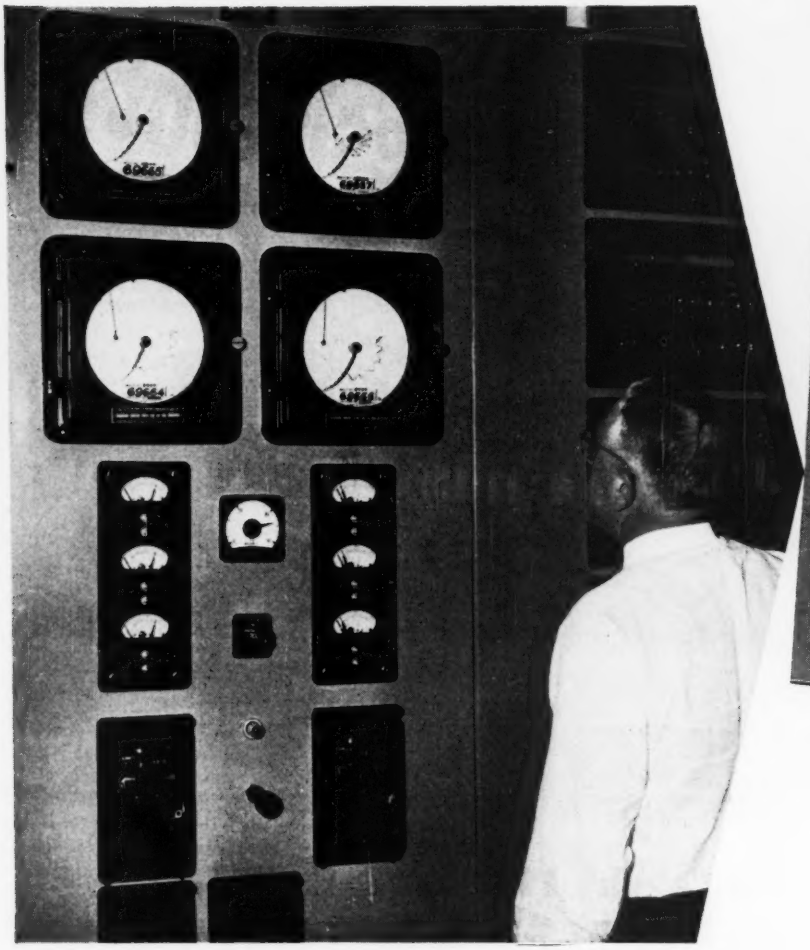
WATER SYSTEMS and advantages of electric operation are demonstrated to farm family

Five Conditions . . . In offering financial aid to customers for purchase of any appliance they do not have, Montana Power makes these stipulations:

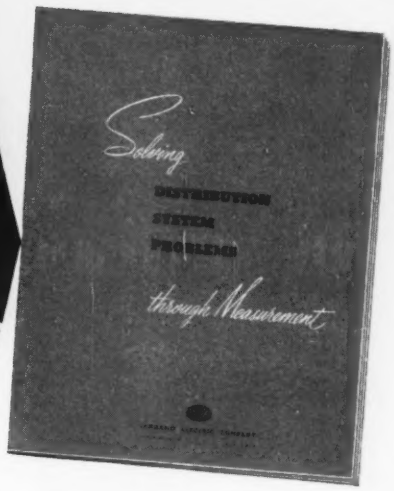
- Coupons are not transferrable but must be used by the customer in whose name they are originally written.
- Any or all appliances purchased must be installed on the customer's premises.
- Appliances must be purchased between May 1 and Nov. 30 and must be in general operation not later than Dec. 31.
- Coupons are good only for new appliances, not replacements. However, they are good for an additional appliance.
- Coupons will be redeemed at full face value by the company from dealers only.

Prior to personal contact of eligible customers by company personnel, the company sent a letter to tell of the coming campaign and to assure company representatives a receptive audience. Every customer was visited before May 1 by the representative who discussed the program, sold him on the advantages of owning one or all of the appliances, and supplied coupons he was entitled to receive. Coupon books were filled out in quadruplicate, with one copy for the customer and one each for the company's main, divisional, and local offices.

In advance of the campaign period, company met with all wholesale and retail distributors of appliances in the



DISTRIBUTION ENGINEERS!



Take the guesswork out of your system operation

"Should we apply corrective measures now, or wait until trouble develops on this circuit?"

You can't afford to use guesswork methods to answer questions like this. Under today's rate of load growth you have the doubly difficult job of giving better service while loading closer to capacity with only a small safety factor.

You need accurate knowledge of load conditions to render good service and still get the best return on your system investment. Such knowledge can be obtained only through *measurement*.

Sangamo's booklet "Solving Distribution System Problems Through Measurement" tells how a number of utilities are solving this problem with permanent installations of Sangamo Thermal Meters. It tells about periodic surveys, too. Just clip the coupon below for *your* copy.

Only Measured Facts are Known Facts

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SM53-6

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

Send my copy of "Solving Distribution System Problems Through Measurement"

YOUR NAME_____

TITLE_____

COMPANY_____

CITY and ZONE_____ STATE_____

Corrosion resistant

Installed over 18 years ago on this bridge, Transite Conduit is still on the job despite the attack of corrosive fumes, weather, and vibration.

Resists the Elements: Transite Ducts are standing up far longer than other materials on this cooling-tower wall despite corrosive conditions. Transite's exceptional corrosion-resistance practically eliminates maintenance and replacement costs through the years.

Outlasts other Materials: When other ducts failed to stand up under the streets of a city in the Far West, Transite Ducts were installed. Their life expectancy is far greater than that of the ducts they have replaced.

That's why TRANSITE® DUCTS stay on the job despite corrosive fumes, soils and weather

If you're looking for a conduit that will stand up for years in tough service . . . use Transite Ducts that not only resist corrosion but are immune to electrolysis, too.

Transite, you see, is made of asbestos and cement . . . two naturally corrosion-resistant materials. It stands up in corrosive cinder fills, salt marshes, and other troublesome soils. It also withstands the attack of smoke, fumes . . . and weather conditions will not shorten its service life. Since it is inorganic and nonmetallic, Transite also is immune to electrolysis or galvanic action.

You will find that Transite Ducts save you money on your cableway system not only by staying on the job longer . . . but by holding down the initial cost, too. For further information write Johns-Manville, Box 60, New York 16, N. Y.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Incombustible. Transite will not burn or contribute to formation of smoke, gases, or fumes. It confines burnouts and protects adjacent cables.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Easy To Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. And, long 10-foot lengths reduce the number of joints in the line.

4. Higher Thermal Conductivity. Cables run cooler in Transite Ducts, reducing I^2R losses, increasing current capacity, and prolonging insulation life.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

program. Dealers were urged to lend direct-mail support and to create dealer follow-ups in sales leads. Complete lists of customer prospects, showing all customers receiving coupons, were supplied to dealers after customer calls had been completed.

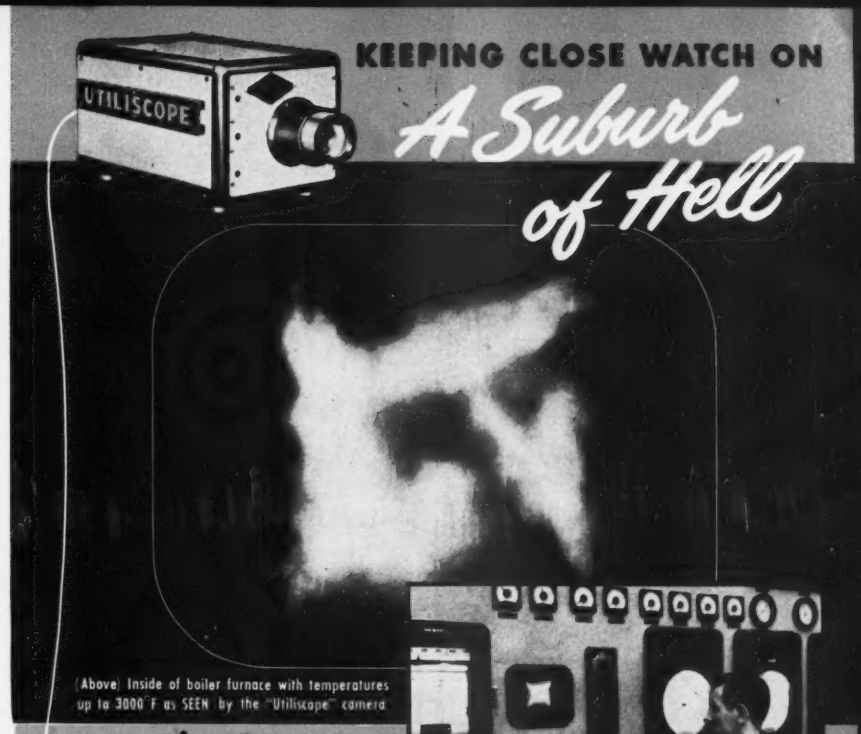
Room of Amazement . . . Designed to sell rather than merely demonstrate electrical appliances, the "Room of Amazement" is a combination demonstration and entertainment show presented in two sessions. It was created by Mary Ann Gates, director of home service, and Edwin R. Buck of the Butte office.

The show will travel about 3,000 miles to put on one-day stands in each of 57 communities. Demonstration session begins at 2 p.m. and consists of two parts, both conducted by the home service advisor in each division. First part is designed especially for the housewife and consists of practical demonstrations of proper use of the electric range. Featured are short cuts to save time, energy, and money. Recipe sheets covering dishes prepared during the afternoon are given to the audience.

Second part of the program includes a showing of Nash-Kelvinator Corp's color film "Just Like Magic." Then the home service advisor presents a program entitled "Your Freezer is Your Pantry." Time also is devoted to food canning, with quick freezing presented as modern method of eliminating much work and still providing a better finished food product. An effort is made to show how the freezer will save time and money in preparing meals for sheep shearers, hay crews, and threshing crews. This point is particularly strong because feeding of these crews has been a real burden for a long time.

Demonstration session closes with taking of registration cards that are used in awarding door prizes. These cards later become prospect lists for dealers participating in the road show. Door prizes consist of the food prepared earlier in the session.

Acts That Sell . . . Evening show consists of 12 demonstrations by Edwin Buck of electric and chemical phenomena that represent important phases in the electrical industry. These acts are similar to General Electric Co's "House of Magic" demonstrations. Woven into Montana Power's show are selling stories that attempt



KEEPING CLOSE WATCH ON

A Suburb of Hell

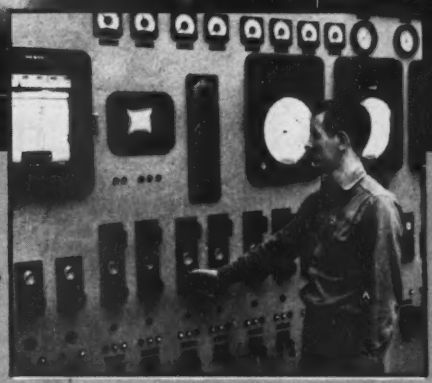
(Above) Inside of boiler furnace with temperatures up to 3000°F as SEEN by the "Utiliscope" camera

Again

DIAMOND

"UTILISCOPE"

(WIRED TELEVISION)



Operator watches "Utiliscope" screen to check furnace conditions.

Gives Eyes to Instruments

The interior of a big power boiler . . . white hot with flaming powdered coal or fuel oil . . . can't be looked at conveniently. This "suburb of hell" is too hot and too brilliant for the human eye to watch continuously.

But it needs continuous watching. Only VISION can ride herd perfectly on the varying conditions of the raging flame . . . give a "sense of reality" to the control operator. There are plenty of instruments but they can't see.

At the Port Jefferson Power Station of Long Island Lighting Co., each furnace has a "Utiliscope" that looks directly into the fire. On a viewing screen in the centralized control room, the operator can SEE conditions that help in eliminating smoke. He can SEE that the ignition torches are operating satisfactorily before admitting pulverized coal or fuel oil. He can also SEE when ignition takes place during lighting off. On low load operation, he can SEE the stability of the flame.

Many processes and operations in industry need close observation for safe, accurate, and efficient control. But often they are too remote, too inaccessible, too hot, too cold, too dangerous, etc. for direct eye observation. The "Utiliscope" can watch these things . . . bring the image where it is needed. Write for bulletin containing suggestions.

TYPICAL USES — Studying destructive tests of engines • Watching flow of molten steel • Checking remote gauge readings • Viewing nuclear research Coordinating materials flow on conveyors • The "Utiliscope" (Registered U. S. Patent Office)

4042

DIAMOND POWER SPECIALTY CORP.

FIRST IN INDUSTRIAL TELEVISION

LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES

Diamond Specialty Limited—Windsor, Ontario

Since 1903, Diamond has Manufactured Quality Equipment for Industry

5 reasons for specifying RT&E TRANSFORMERS

5 HIGH IMPULSE LEVEL
Impulse level with built in safety factor considerably exceeds industry standards and is accomplished by—low layer insulation voltage stress—stepped back and graded overinsulation—space wound windings at coil ends—taps positioned in center of H.V. windings.

4 OIL FILLED PRIMARY BUSHINGS
Primary bushings are a wick-fed oil-filled type to eliminate corona and radio noise.

3 EXTERNAL TAP CHANGER
All tap changers are externally operated to avoid opening of unit—breaking of factory cover seals—contamination of oil from moisture and dirt—provides a greater convenience for tap changing and tap position identification in a matter of seconds. Unit remains sealed for longer life.

2 STANDARD 5 YEAR GUARANTEE
All RT&E transformers are guaranteed for 5 years from date of shipment from factory, free from defective workmanship and materials.

1 D. B. P. C. (inhibited oil)
All RT&E transformers are inhibited with D.B.P.C. to reduce oxidation —sludge—corrosion—acid formation and to increase transformer life.

SIZES
3 THRU 500 KVA
2400 TO 14,400 VOLTS
SINGLE & DOUBLE BUSHINGS

WRITE FOR CATALOG

432 N. 8TH ST. MILWAUKEE 3, WISCONSIN
RT&E Co.
BRANCH PLANT: WAUKESHA, WISCONSIN

to create a desire for ownership of one or more of the appliances featured in the campaign.

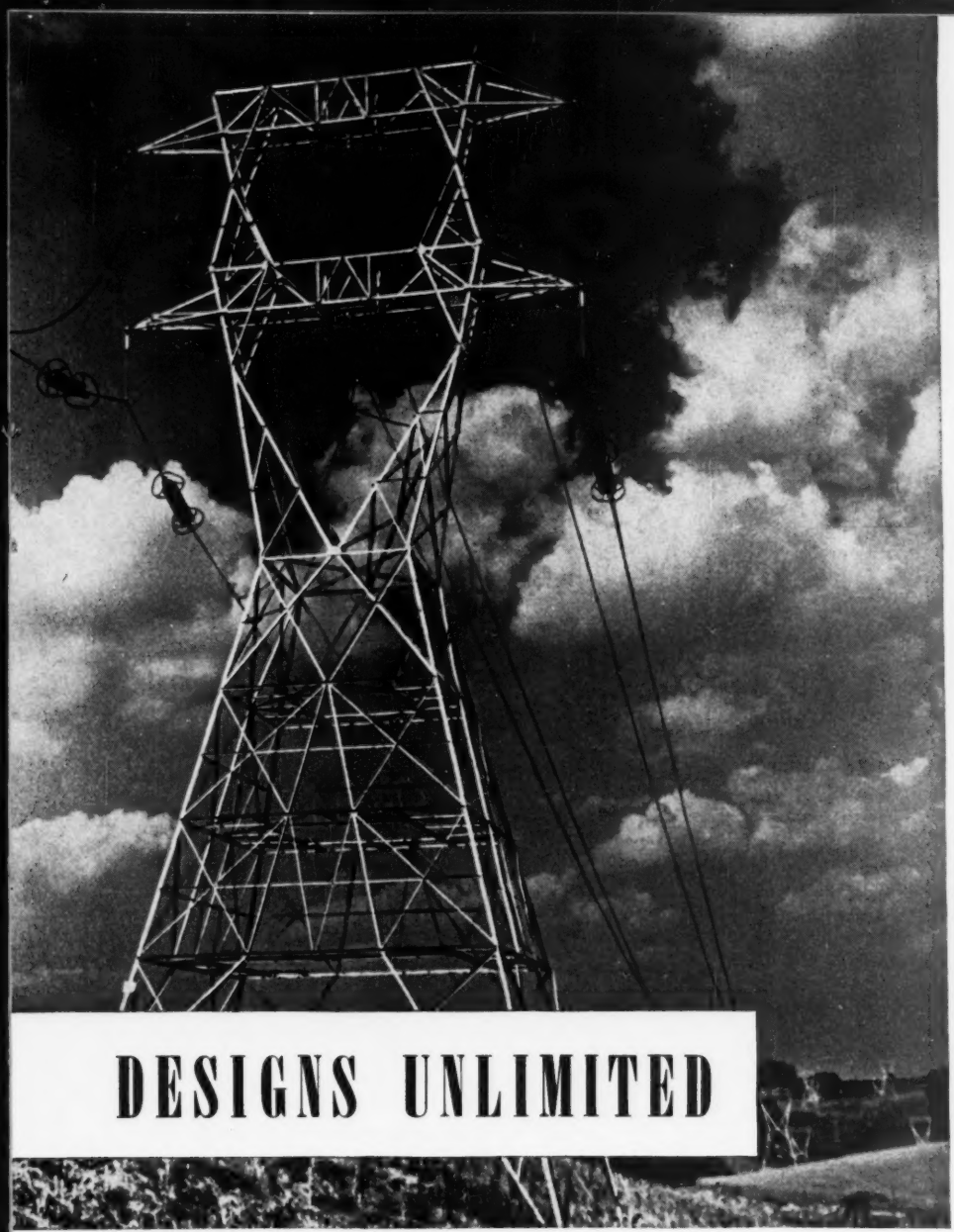
In addition, local appliance dealers display their merchandise around the hall in which the show is held. At the close of the evening performance, ham sandwiches and coffee are served at the dealers' display booths to give dealers further opportunity to locate sales prospects. Most of the shows are being held in combination gymnasium-auditoriums that are characteristic of small towns in Montana. They are ideal for the road show because they offer adequate stage facilities as well as sufficient space for dealer displays.

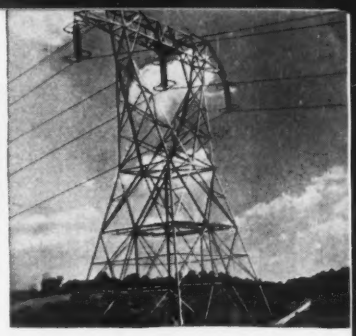
All communities to be visited by the show are small but they were selected on basis of providing best possibilities for a large turnout. Attendance figures for May indicate how well the shows are attracting farm customers. Total show attendance was 5,775 at 17 communities ranging in population from 104 to 2,400, average about 990. In general, smaller towns provided a larger attendance, compared to population, than did larger communities. An extreme example is town of Carter (pop. 104) where 212 persons came to the performance.

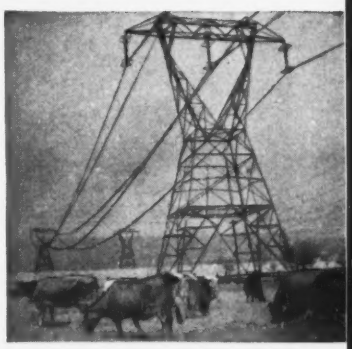
Cost of the entire show is borne by the company, with the exception of a $15-limit door prize offered by each participating dealer. These prizes are awarded from a registration list taken for the evening show. Copy of this list is sent to dealers immediately after the show leaves the area.

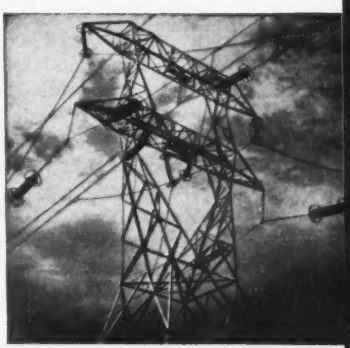
Plenty of Notice . . . To insure good attendance at the road show over the entire circuit, the company is making use of advance notices, direct-mail pieces, window posters and newspaper stories. An advance notice sheet was left with the customer at the time the company representative called to offer coupons. It briefly explains the show and carries the date, time and place the show will visit the customer's town. In addition, a direct-mail brochure is mailed to customers about ten days before show date.

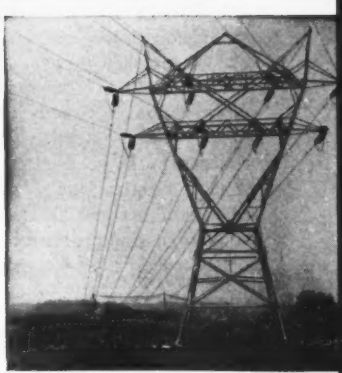
From the company's publicity department, advertisements for local newspapers are being mailed directly. This department also prepares and sends directly two supporting news stories. The first is run two weeks prior to the show and the second in the issue immediately preceding show











DESIGNS UNLIMITED

If your engineers have their own ideas on tower design, well and good. We will follow them to the letter and adhere closely to specifications. Your engineers realize, as we do, that despite general similarity no two towers are alike. Each tower must be designed for its particular location and purpose.

Let us apply our four decades of experience in building towers for any and all conditions of terrain and load to your power transmission problems.

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
PITTSBURGH 22,
PENNSYLVANIA

BLAW-KNOX

GAI-TRONICS
POWER PLANT COMMUNICATION SYSTEMS . . .

Prove that ENGINEERING and EXPERIENCE make the BIG difference!

CONSULTING

DESIGN AND ENGINEERING

FABRICATION

OPERATION

The *completely engineered* GAI-Tronics power plant communications system is designed and built by men associated with the design, construction, and operation of power plants throughout the world. Their "know-how" insures the solution to your power plant communication problems.

Two-way or group conversations can be carried on over telephone-type handsets and sound projectors *without* using special booths. The projectors can be used for paging and issuing emergency instructions. If you desire, telephone-like privacy may be had with the flick of a switch even though the system remains alerted for emergency use. The completely engineered GAI-Tronics system can be installed by *your* maintenance men. With a GAI-Tronics system, your power plant is equipped with a custom-designed, internal communication system that is easy to instal!; easy to operate; easy to maintain. A GAI-Tronics power plant communication specialist will be glad to discuss your communication problems.

GAI-TRONICS
CORPORATION
READING, PA.

GAI FOUNDED 1906

A SUBSIDIARY OF GILBERT ASSOCIATES, INC.

FREE!

A booklet—Power Plant Communication Systems—or a convincing demonstration in your plant. The portable GAI-Tronics system designed by our engineers for this specific purpose can be scheduled for your plant upon request without obligation. Write today. Dept. G-T.

date. This issue also carries the company advertisement for the show.

Window displays are forwarded to various communities for display in the community for at least two weeks prior to show date. A printed booklet, "How to Get the Most Out of Living Electrically", is distributed to each family at the evening show.

Beyond presenting the road show in their divisions, home service advisors assisted in making calls on rural customers to leave coupons and sell uses of appliances. They attended dealer meetings and will assist dealers throughout the campaign. Lastly, they will conduct demonstrations in all areas where rural customers will not be reached by the road show.

Farm Motors Made Easy to Understand

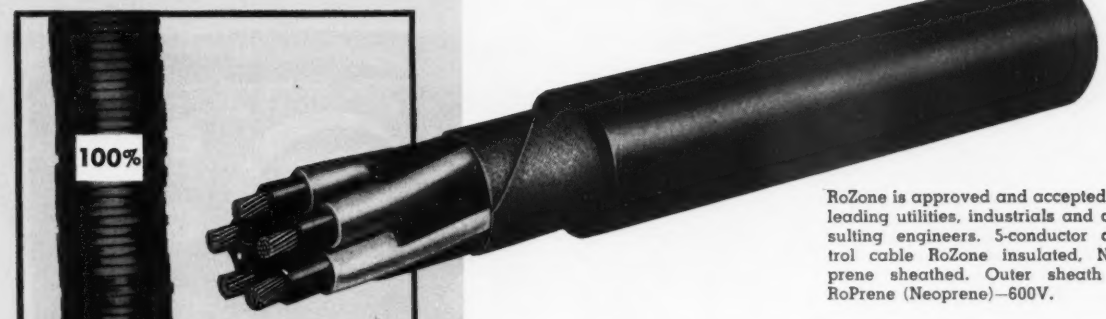
Excellent for its purpose is "Selecting Farm Electric Motors, Controls and Drives," recently published by the Southern Association of Agricultural Engineering and Vocational Agriculture. Avoiding technical language and well illustrated, the 36-page booklet was developed for high school teachers and farmers.

Covered in simple and practical terms are types of motors commonly used on farms, their advantages and limitations in different uses, their control and protection, and their proper connections to driven machines. A comprehensive set of tables is included telling sizes required by various farm applications, approximate performances in work done, and recommended operating speeds.

The publication is available from the Coordinator's Office, Division of Agricultural Engineering, University of Georgia, Athens, Ga.

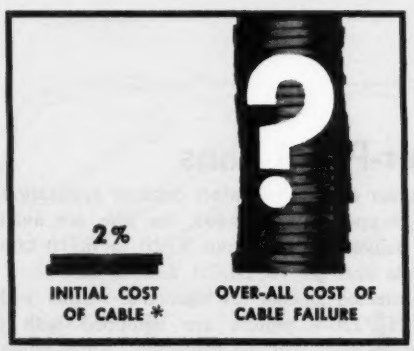
"Adsorption-Type" Dehumidifiers Marketed

Now available to householders throughout the country are "adsorption-type" dehumidifiers of a new design in decorator finishes made by Dryomatic Corp, Alexandria, Va. Currently in distribution is Model 21, which stands less than 2 ft high and plugs into any standard home current supply for automatic operation wherever humidity damage is apt to occur. Also available is a model which includes a humidistat which regulates room humidity to any level.



RoZone is approved and accepted by leading utilities, industrials and consulting engineers. 5-conductor control cable RoZone insulated, Neoprene sheathed. Outer sheath of RoPrene (Neoprene)—600V.

Look at Cable Cost both ways



You can look at the cost of cables for generating stations two ways.

One is the initial cost of the cable in relation to the over-all cost of the station. The other is initial cable cost related to the cost of cable failure. In both respects, the initial cost of the cable is practically negligible.

Both add up to the same thing. You can't afford to sacrifice quality for price. It truly costs less to buy the best.

That's why so many utilities specify Rome RoZone insulated cable for primaries up to 15 KV, for station control cable, for street lighting, for distribution and many other requirements.

This premium quality, ozone-resistant oil base type insulation exceeds all requirements of ASTM specification D-574 and offers these basic advantages:

1. High resistance to aging. Longevity of original characteristics.
2. On the basis of long-time test, dielectric strength exceeding 400 volts per mil. Surge or impulse strength proportionately high.
3. Utmost resistance to corona and ozone cutting.
4. Low dielectric loss.
5. Exceptional electrical stability in water.

The Rome Power and Control Cable Catalog contains complete information on Rome RoZone. Send for your copy today!

It Costs Less to Buy the Best

ROME CABLE
Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

ROME CABLE ROME, N.Y.

* AVERAGE INVESTMENT IN WIRING IN STEAM GENERATING STATIONS 1.9% of station investment, excluding land. $2.75 per KW of nameplate capacity. (Source: "Continuing Property Records for Station Piping, Wiring and Conduit.")

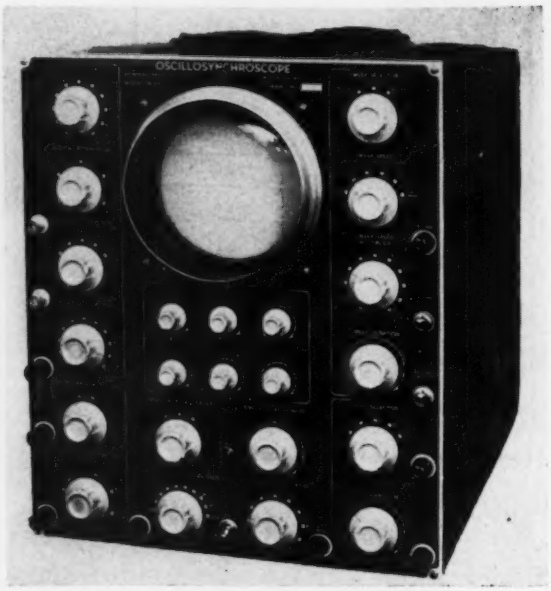
NEW EQUIPMENT

Reclosers

Type FR reclosers have a one-way seal for moisture protection. The seal, placed around operating handle shaft, permits release of internal pressure but is said to prevent humid air from entering. All other openings are fully gasketed.

Current ratings added are 70, 100, and 140 amp, making a complete line from 5 to 140 amp, 2.4 to 14.4 kv, and 125 to 2,500 amp interrupting capacity.

General Electric Co, Schenectady 5, N. Y.



Oscillosynchroscope

Model OL-23 features 4,000-v accelerating potential, vertical amplifier bandwidth flat from 5 cycles to 10 Mc with a sensitivity of 0.15 v, peak-to-peak, per inch, and triggered or recurrent sweeps from 0.1 microseconds per cm.

Instrument is designed for 115/230-v operation at an input of 300 w. Its outside dimensions are 15¾ x 13¼ x 22 in.

Browning Laboratories, Inc, Winchester, Mass.

Weather-Proof Fans

For transformer cooling and other outdoor applications where fan must operate unattended, the fans are available with air delivery ratings from 2,820 to 6,710 cfm. Aluminum blade sizes are 16, 20, 24, and 30 in.

Fans are protected against the elements. Units with single-phase, 110/220-v motors are equipped with a automatic reset, thermal overload protector. Three-phase, 220/440-v motors are also available.

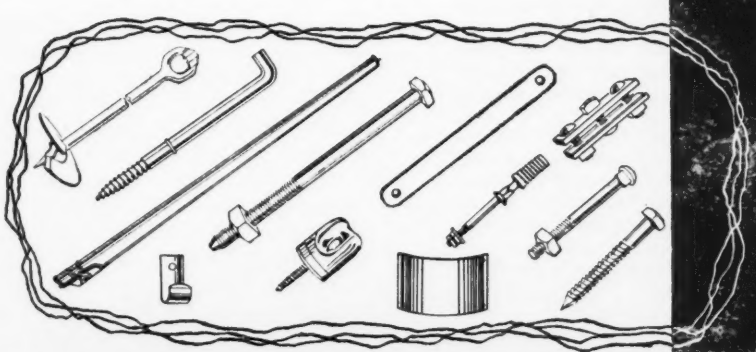
Robbins & Myers, Inc, Springfield 99, Ohio

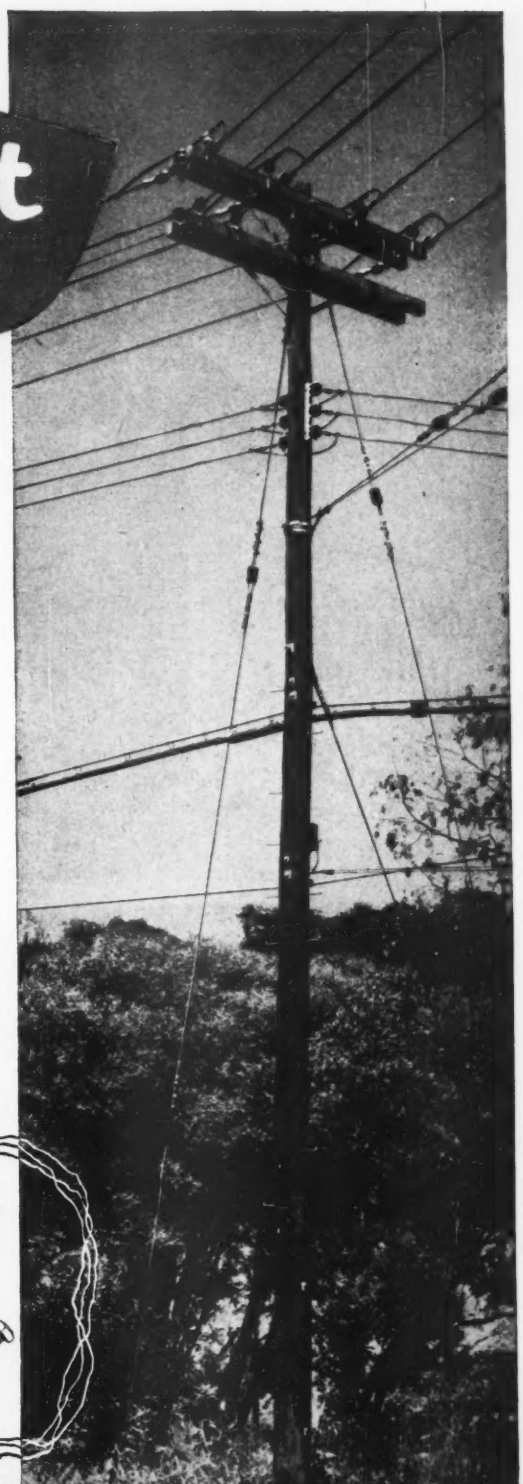
ARMED *Against* TROUBLE

with HUBBARD Pole Line Hardware

HUBBARD'S 4000 items of Pole Line Hardware are planned to save the Lineman and the Line. From arm to anchor, every product is designed for easy installation and long-life protection. All steel is Hubbard Double Dip Hot Galvanized to stand in all kinds of weather through the years.

Hubbard Hardware is manufactured in three strategically located Hubbard Plants in Pittsburgh, Chicago, and Oakland, California, and is carried in stock by more than 200 leading Electrical Distributors throughout the United States. There's a Hubbard Distributor near you.





HUBBARD AND COMPANY

ESTABLISHED 1842

PITTSBURGH • CHICAGO • OAKLAND CALIFORNIA

"Hang the load on Hubbard Hardware!"

NOW! MARCUS
LIGHTING TRANSFORMERS
for quicker, easier installation

THREE PHASE INSTALLATION

• ECONOMICAL
• COMPACT • EFFICIENT

1 to 3,000 KVA up to 15,000 Volts to meet Individual Requirements
- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

Representatives in Principal Cities

New MARCUS "Type C" general purpose lighting transformers, for installation either indoors or outdoors, are available for immediate delivery in sizes from 1 to 15 KVA, single phase and three phase. The full lighting line is available NOW, from stock, in sizes from 1 to 50 KVA, single and three phase, up to 600 volts. All contain Class B hi-dielectric, hi-heat magnet wire insulated with DuPont's miracle *"Mylar"* polyester film with at least ten times the puncture strength of standard magnet wire.

New MARCUS "Type C" indoor-outdoor lighting transformers are constructed with electrically welded sheet steel case. Scientifically placed vents provide completely weather-proof ventilation. Self-contained wiring compartment means faster-than-ever installation.

Write for price list

"Mark of Quality"

MARCUS
TRANSFORMER CO., Inc.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

Ac Shunt Box

For use with a MV-12A voltmeter, the MV-121 shunt box has shunts for measuring 1 microamp to 3 amp with a frequency response within 0.2 db from 20 cps to 6 kc depending on the load.

Millivac Instrument Corp, Schenectady 6, N. Y.

Indicating Controller

Capacitrol, Model 221C, has an anticipating action added to the Electronic Link to give straight line control. A resistor network and relay circuit anticipates the departure of temperatures caused by various heat transfer lags and load requirements.

Measuring accuracy is provided by a precision high-resistance galvanometer. Interchangeable voltage plugs are provided for 115 and 230 v ac.

Barber-Colman Co, Rockford, Ill.

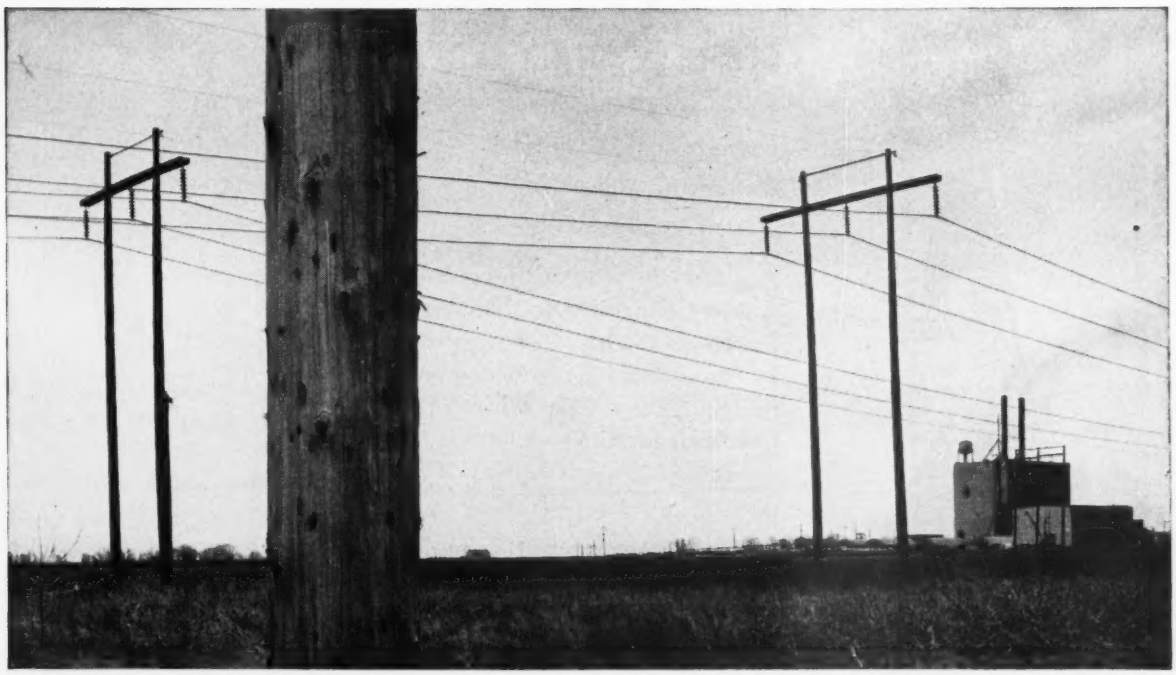
Glass Tape

Type CX is used for protective wrapping, tying, filling, and mechanical reinforcing purposes for Class A work. Having a high strength per unit thickness and space-saving thinness, the glass fiber is woven with

DOW

H-FRAMES BUILT TO LAST BY A LEADER IN POWER TRANSMISSION

Consumers Power protects new Erie transmission line with clean PENTA, the modern wood preservative



The Dow Chemical Company
Dept. PE 3-2B7, Midland, Michigan

- ☐ Send me free booklet, "Pointers on Penta."
- ☐ Send me list of PENTA treating plants.
- ☐ I am interested in the application of PENTA to_____

Name_____

Title_____

Company_____

Address_____

City_____ State_____

Congratulations to Consumers Power on the recent completion of the first two units of its new Justin R. Whiting power station and three important transmission lines at Erie, Michigan.

We are proud that PENTA*, the clean wood preservative, was elected to play a part in keeping this new network of power lines sound and serviceable for many years to come. This is a high compliment from a company well known for its progressive policies and dependable service.

From a standpoint of service and dependability these PENTA-treated H-frames will give a good account of themselves.

PENTA-treated poles and crossarms give positive protection against decay and termite attack.

Along with lasting protection, PENTA-treated poles are clean and attractive. They present a pleasing appearance along the countryside. Because PENTA gives a clean treatment, linemen find them easy to work on. Write for more information about *PENTAchlorophenol, the clean, modern wood preservative. THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

UNIFORMITY...

never a surprise

when you use

BERMICO®

FIBRE CONDUIT

Uniform wall thickness

Uniform diameter of bore

Uniform impregnation

Uniform quality of fibre

Automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections – these are the things that guarantee Bermico's uniformity of dimensions, specifications and quality.

For surest cable protection, be sure to specify Bermico Fibre Conduit. Made by Brown Company from sturdy wood fibre, impregnated with pitch, it is–

• Light • Tight • Strong • Waterproof • Acid-Resistant • Smooth Inside and Out

distributed by

WESTINGHOUSE

Electric Supply Company. Offices in principal cities

BROWN COMPANY, Berlin, New Hampshire

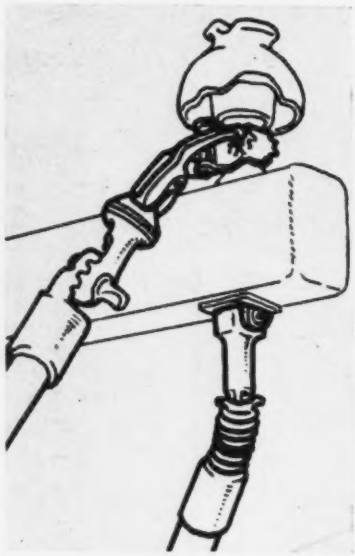
BROWN CORPORATION, La Tuque, Quebec

SOLKA ● CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

continuous filament glass yarns and is 0.004 in. thick. Present available widths are ½, ¾, 1, and 1½ in.

Tape is treated to permit it to be applied by both machine and hand winding methods.

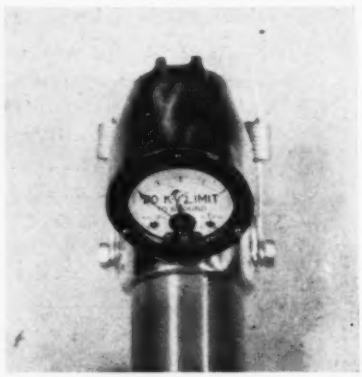
Insulation Manufacturers Corp, Chicago, Ill.



Hot-Line Tools

The two tools are designed to simplify insulator replacement on hot 15-kv lines. Universal Pin Insulator Grip is for holding and placing insulator and pin. Magnetic Wrench Socket will hold a ⅝-in. nut and washer and is used for tightening.

Bodendieck Tool Co, Taylorville, Ill.

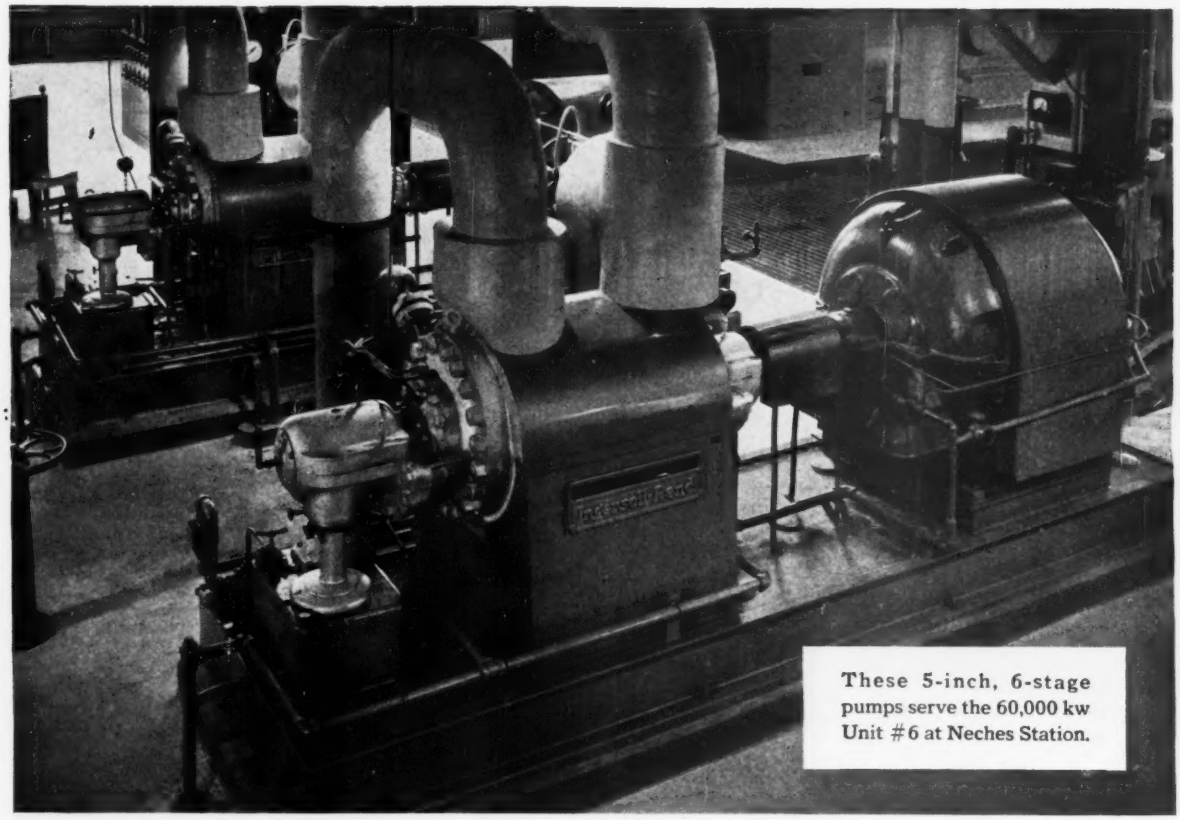


Voltmeter

Touch Voltmeter is used to indicate the presence of voltage on a conductor by touching it with the tester head.

DOUBLE-CASE BOILER FEED PUMPS GIVE TOP PERFORMANCE

AT Neches Station of Gulf States Utilities



These 5-inch, 6-stage pumps serve the 60,000 kw Unit #6 at Neches Station.

Ingersoll-Rand Class CHTB pumps serve latest units at Beaumont, Texas steam plant supplying highly industrial Texas-Louisiana Gulf Coast area.

When Gulf States Utilities added Units #5 and 6 to their Neches generating station in 1951 and 1952, they selected Ingersoll-Rand boiler feed pumps. Two of these modern CHTB pumps serve each of the duplicate 60,000 kw units, designed and built by Stone & Webster Engineering Corporation.

Gulf States also operates four I-R 7-stage boiler feed pumps on 40,000 kw Unit #4, installed in 1949.

For dependable boiler feed pumps, whatever your pressure and capacity requirements, call on Ingersoll-Rand — first with the finest in pumping equipment. Your nearest Ingersoll-Rand branch office will be glad to consult with you on the proper selection.

Ingersoll-Rand

894-10

Cameron Pump Division
11 Broadway, New York 4, N. Y.

CONDENSERS • GAS AND DIESEL ENGINES • TURBO-BLOWERS • ROCK DRILLS • COMPRESSORS • AIR AND ELECTRIC TOOLS

DRAFT FANS GO on GREEN

- Two Induced Draft Fans, each 198,000 cfm; 300°F stack gas at 15" static pressure.
- And special features include: radial tip blades, erosion-resistant wheels, control type inlet dampers, air-cooled bearing for outdoor service.

This installation, located in the South, adds to the mounting evidence that Green Draft Fans are very much in the boiler plant picture, both utility and industrial... evidence that they are high on the specification lists of leading consulting engineering firms and on the owners' lists of acceptable equipment.

There are numerous things about Green Induced and Forced Draft Fans that make them desirable auxiliary equipment for any boiler. We suggest that you have the basic facts at hand when you start planning for *your* fans. Send for our Bulletin 168 and in writing, tell us about your requirements.

Photo above shows the Green ID Fans being installed in the Chesterfield Power Station Extension of the Virginia Electric and Power Co., at Drewrys Bluff, Virginia.

THE GREEN Fuel Economizer COMPANY INC.

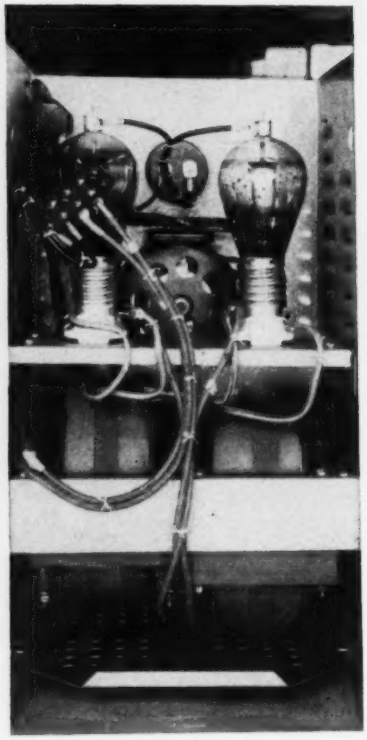
- Economizers
- Fans
- Air Heaters
- Cinder traps
- Aerodyne Dust Collectors

BEACON 3, NEW YORK

Voltage shown is the voltage to ground. The instrument is rated at 20 kv and has four equal scale graduation.

When testing high voltage circuits the instrument is attached to a hot stick. For 600-v circuit full scale deflection is obtained by holding the instrument's bakelite tube in hand.

Western Electro-Mechanical Co, Inc, Oakland 7, Calif.



Battery Charger

It is designed for use with up to 10 12-v batteries or 20 6-v batteries, has mercury vapor tube rectifiers, and operates from any standard convenience cutlet. Louvers in the top and sides, and holes in the bottom provide ventilation inside the 21 x 11⅝ x 13⅝-in steel cabinet. Charging rate is zero to 6 amp.

Electronic Rectifier Co, Rochester, N. Y.

Two-Way Radio

The FM transmitter receiver is complete with controls, associated power supply, antenna, and microphone, mounted in a single housing. Weighing 50 lb and operating in the 152-174 Mc band, Multi-Master can

ON THESE TWO INSTALLATIONS

Vacuum dried, oil impregnated crepe paper

NOW IN PRODUCTION AT IRVINGTON!

Your requirements for crepe paper insulation can now be supplied by Irvington — the *leader* in electrical insulation.

Crepe paper and oil are degasified under very high vacuum to assure freedom from moisture and provide good electrical properties.

The paper is packaged in cans to meet your specific requirements for number and size of rolls. Roll sizes include ½" x 4 yards, 1" x 4 yards, 1" x 18 yards, 1" x 36 yards. Cotton yarn and copper mesh can also be included.

Use Irvington Crepe Paper on your low- and medium-pressure gas-filled cable — and also on oil-filled and pipe-type cable.

Look to
IRVINGTON
for Insulation Leadership
INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

Other IRVINGTON Insulations for Utilities

Harvel Oil Stop 621 • Fibron® Plastic Tape • Temflex® 105 Tape • No. 32 Red Enamel

Send this convenient coupon now

Irvington

VARNISH & INSULATOR COMPANY

21 Argyle Terrace, Irvington 11, New Jersey

Plants: Irvington, N. J.; Monrovia, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company EW-7/53
21 Argyle Terrace, Irvington 11, N. J.

Gentlemen:

Please send me Technical Data Sheet on

☐ Irvington Crepe Paper
☐ the following products_____

Name_____ Title_____

Company_____

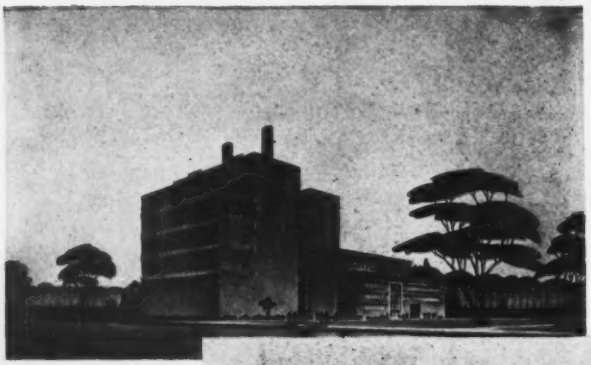
Street_____

City_____ Zone____ State_____

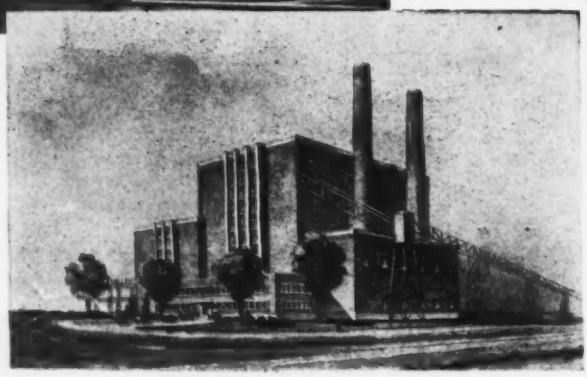
ON THESE TWO INSTALLATIONS

the AEROTEC SERIES

Assures 97.5% FLY ASH COLLECTION Efficiency



LEFT: The 264,000 kw (four units) J. Clark Keith Generating Station of The Hydro-Electric Power Commission of Ontario at Windsor, Canada. H. G. Acres & Co., Niagara Falls, Ontario, Consulting Engineers.



RIGHT: The 400,000 kw (four units) Richard L. Hearn Generating Station of The Hydro-Electric Power Commission of Ontario at Toronto, Canada. Stone & Webster Engineering Corp., Boston, Mass., Engineers and Constructors.

Here's on-the-job proof that Aerotec Series Mechanical-Electrical Dust Collectors are used for continuous efficiency. Guaranteed 97.5%, at normal full load the overall efficiency is anticipated as high as 99% at these two Canadian generating stations of The Hydro-Electric Power Commission of Ontario. Aerotec Series Collectors serving each plant combine a design 3RAS Mechanical and an Electrical Precipitator.

In the Mechanical unit, small diameter, permanent molded aluminum tubes provide high efficiency. Exclusive Aerotec pocket type collecting electrodes in the Electrical Precipitator reduce reentrainment of dust in the gas stream, contributing to a sharp improvement in stack appearance. The combined actions of these units assure maximum dust collection efficiency. Many Aerotec Series installations verify that fact.

Your plant can eliminate dust nuisances with Aerotec equipment just as many well-known companies have done. This highly successful performance is a reliable measure of Aerotec ability to solve your dust collection problems. Write our Project Engineers today!

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONNECTICUT

(*Offices in 38 Principal Cities*)

Canadian Affiliates: T. C. CHOWN, LTD.

Montreal 25, Quebec Toronto 5, Ontario

THE AEROTEC CORPORATION

GREENWICH, CONN.

be used as a fixed station or a mobile unit. It is said to be easily adapted to narrow band operation.

Unit is available for operation from the following power sources: 6, 12, or 64 v dc or 117 v ac. Either 2, 10, 25, or 35-w outputs are available for ac or dc units. RF output of 60 w is available for ac only.

Bendix Radio Division, Bendix Aviation Corp, Baltimore 4, Md.

Engine Generator

Model 1A21, available for operation on gasoline or natural gas, has 1-kw output and is designed for various portable and semiportable jobs. Automatic starting is one of its features.

When a load of 40 w or larger is connected to terminals the unit will start. Automatic stopping is accomplished by switching off the load. Other features claimed include elimination of radio interference and improved voltage and frequency regulation.

Kohler Co, Kohler, Wis.

Flag Holder

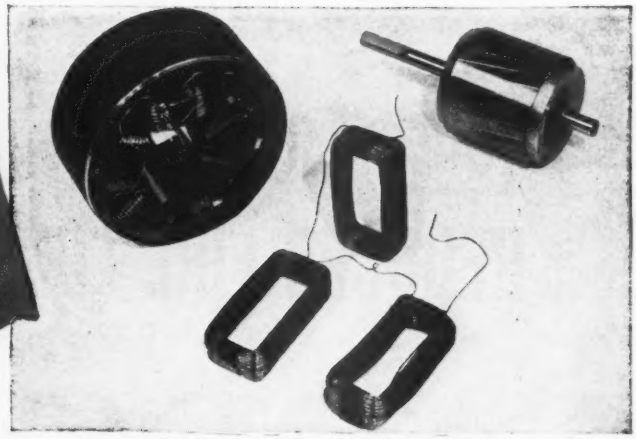
For use on pole trucks, the holder fastens around any size pole and holds flag in upright position where it is readily seen. It detaches instantly when desired to remove from pole, and is made of malleable iron with a chain.

Industrial Products Co, Philadelphia 33, Pa.

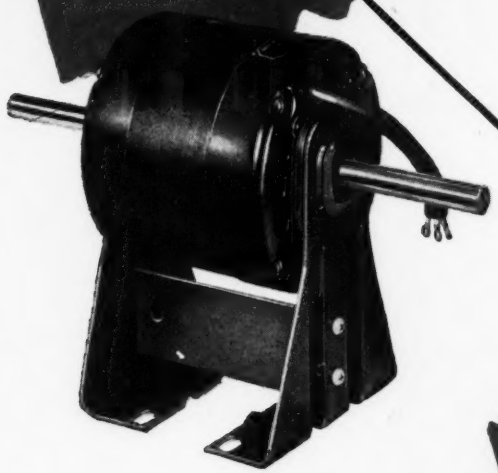
Visibility Measurer

For use at airports or highways, the Transmissometer measures visibility conditions by a photoelectric device.

MARCO SHADED POLE TRI-MOTORS



For Quietness, Efficiency, and Long Life — stators are made from special silicon steel laminations, heat-treated, aligned under hydraulic pressure and solidly riveted. Slot cell insulation is tough Natvar 100% rag paper-varnished cambric, cuffed to fit. Coils are wound from a single length of polyvinyl formal coated magnet wire, eliminating soldered connections. The assembled unit is impregnated with oil and moisture proof varnish and baked in infra red ovens for a permanently sound insulation job.



Are Insulated with NATVAR SLOT CELL INSULATION

Marco Industries, Inc., Depew, N. Y. manufactures "quality motors tailored to your product at readymade prices". They are available in 1/100 — 1/8 H.P. range; 4 and 6 pole; 1, 2 and 3 speed; and in open, enclosed, or fan cooled types.

Their quiet, efficient performance in air moving equipment, office machines, pumps, and many other applications is the result of excellent basic design, modern production and test methods, and careful selection of materials. Natvar Slot cell insulation is used because of its uniformly high dielectric strength and resistance to abrasion, oil, and moisture.

If you need insulating materials with good physical and electrical properties, you can depend on Natvar flexible insulation. It will pay you to get in touch with your distributor or with us direct.

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Varnished-lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 22

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

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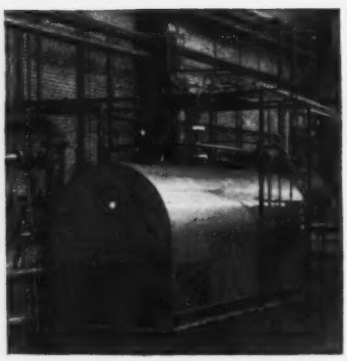
221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

Yours for REDUCED FIRE LOSSES

CARDOX Experience

The Priceless "EXTRA" You Don't Pay for in CARDOX

Low Pressure Carbon Dioxide Fire Extinguishing Systems*



EXPERIENCE is the one thing that can't be copied.

CARDOX originated and created Low Pressure Carbon Dioxide Fire Extinguishing Systems many years ago.

Since then CARDOX has installed thousands of successful Systems—has held steadfastly to its never-ending research and engineering program for the continuous betterment of CARDOX fire protection.

As a result, CARDOX' experience and knowledge of low pressure carbon dioxide and its application are unapproached—literally years ahead.

This is the priceless "extra" that comes to you with every CARDOX System.

Approved by:
Underwriters' Laboratories, Inc.
Manual Systems—1940
Automatic Systems—1941

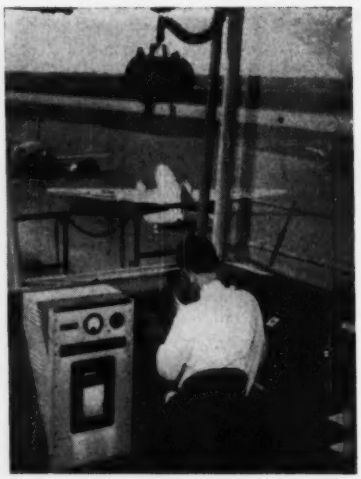
Factory Mutual Laboratories
Manual Systems—1942
Automatic Systems—1942

First Installation—1939
Thousands of Systems since, for most of the nation's leading corporations and industries.

*** Covered by U.S. and foreign patents, issued and pending.**

CARDOX CORPORATION

BELL BUILDING • CHICAGO 1, ILLINOIS • *District Offices in Principal Cities*

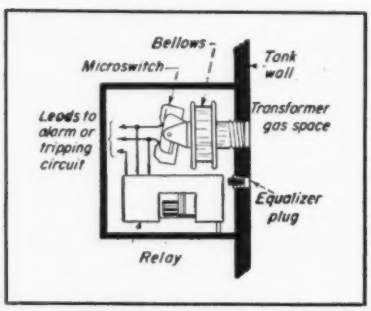


A projector, installed along a runway, sends a light beam across a 500-ft span to a receiver. Here it is picked up, funneled into a photoelectric element, transformed into an electronic signal, amplified, and transmitted to an indicator and recorder combined.

Two scales of a milliameter, installed in the Indicator-Recorder, marked for 0 to 100%, indicate visibility. A graph records the results.
Crouse-Hinds Co, Syracuse 10, N. Y.

Industrial Alarm

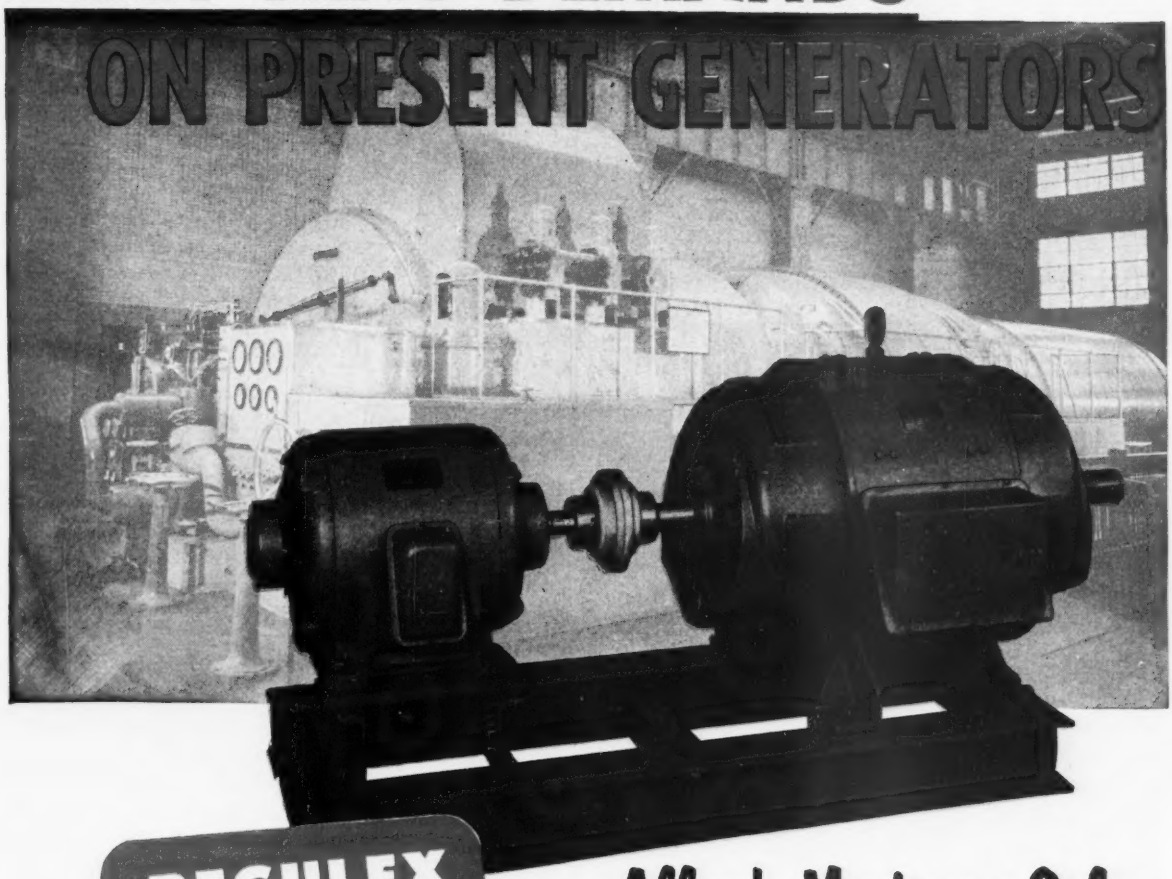
Automatically and continuously self-supervised, the circuit signals operator if alarm system becomes inoperative due to failure of any component in the system itself. Plug-in design provides for rapid replacement. They may be used for either normally open or normally closed field conditions.
Scam Corp, Chicago 18, Ill.



Pressure Relay

For protection of power transformers from internal faults. It operates on a rate of pressure change and isn't

MEET NEW DEMANDS ON PRESENT GENERATORS



REGULEX
Voltage Regulator

Affords Maximum Safe Kilowatt Output at Any Power Factor Loading

IF GROWING PAINS are taxing your plant productivity . . . if ever-increasing demands require closer regulation for your present generating equipment, consider the new efficiency gained by installing a *Regulex* voltage regulator.

Automatic minimum excitation provided by the *Regulex* voltage regulator permits generator operation close to the stability limit . . . much closer than manual operation allows. The sensitivity and exceptional response of the *Regulex* voltage regulator and associated equipment establish and maintain a safe ratio between generator load and field current . . . increase operating limits at any given power factor load . . . assure the best reactive kva division. This means maximum kilowatt output — more power to sell from your present capacity.

Get all the facts from your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4018

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

AT DUSK...

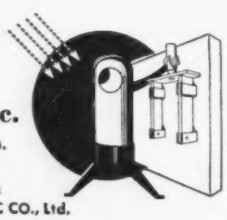
...FISHER-PIERCE PHOTOELECTRIC CONTROL

When street lighting is controlled by Fisher-Pierce, lights *automatically* turn on the instant that natural light intensity falls below a safe level . . . regardless of time of day, season, climate or weather conditions. And, at dawn, lights remain on until natural light is sufficient for safety. No matter how modern your street lighting is, it is not adequate unless the lights are *on whenever natural light is insufficient for safety and protection.*

Fisher-Pierce Photoelectric Controls have been proven by the experience of hundreds of utilities — proven for performance, for technical operating features and for true economy.

When you consider augmenting or modernizing your street lighting, get in touch with Fisher-Pierce. The extensive Fisher-Pierce engineering service organization is at your service.

Write for Bulletin 63300C.



The FISHER-PIERCE CO., Inc.
82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP. 100 E. 42nd STREET NEW YORK 17, N.Y.

IN CANADA: NORTHERN ELECTRIC CO., Ltd.

affected by pressure changes common to transformer operation.

Increased gas pressure, with an internal fault, is transmitted from the transformer case through a tube to the relay. This actuates a bellows that is sensitive to a rate of pressure rise as low as one oz per sq in. per sec.

A microswitch connected to the bellows will either sound an alarm or trip a breaker to take the transformer out of service. A manually operated switch is provided to reset the relay.

Faults producing a pressure rise of 10 to 15 psi per sec cause the relay to operate in two to three cycles.
Westinghouse Electric Corp, Pittsburgh 30, Pa.

MORE NEW PRODUCTS
about which you should know

Unitronics, Inc, Ferguson, Mo., announces a **counter** designed for automatic control of four-pole motor coil windings . . . Astron Corp, East Newark, N. J., has a new molded plastic **paper capacitor** for continuous operation at 85 C.

Mueller Electric Co, Cleveland 14, Ohio, announces **a flexible insulator** that fits over alligator clips . . . Remont Manufacturing Co, Lombard, Ill., has a **soldering flux** for use on iron, steel, copper, bronze, brass, zinc and terne plate.

John B. Moore Corp, Nutley 10, N. J., announces three non-combustible safety **solvent products** that are said to have comparatively low toxicity and high product efficiency . . . Daven Co, Newark, N. J., has a line of wire wound **resistors** that have an additional stranded lead wire between winding and terminal.

Adalet Manufacturing Co, Cleveland, Ohio, announces a line of electrical **conduit fittings** that will fit all standard sizes of service entrance cable and many round cables . . . Boston Woven Hose & Rubber Co, Cambridge 39, Mass., has a splicing **tape** for all electrical applications. It is claimed to have a dielectric strength of 1,000 per mil . . . Hexacon Electric Co, Roselle Park, N. J., has a **soldering iron** which can be connected to either 6- or 12-v supplies.

Why Alabama Power Company is Promoting the HEAT PUMP

Mr. Easter is seen in the picture with C. W. Cheatham, Alabama Power Company's heating and air conditioning engineer, and J. P. Brown, the Company's Manager of Residential Sales.

"We believe that the heat pump can become one of our most important sources of residential and commercial revenue and that it also will be the means of our customers getting even greater value from their use of electric service—that's why we are enthusiastic about the possibilities of the heat pump and will actively engage in its promotion." That's the viewpoint of E. C. Easter, Vice President of Sales for Alabama Power Company. He says further, "For many years we at Alabama Power Company, in association with other electric utility companies in the Southeast, have followed closely the development of the heat pump. We have engaged in laboratory and field evaluations and have participated in the sponsorship at Southern Research Institute of a continuing research project on the heat pump. We are confident that the heat pump offers great promise as the full-time successor to part-time air conditioning."

Here is Alabama Power's record in heat pump promotion:

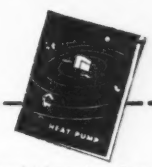
1. Installed heat pumps in Company offices in Birmingham (six years ago), Phoenix City, Brewton, Magella, Gorgas and Enterprise. According to Alabama air conditioning and heating engineer C. W. Cheatham: "All have given satisfactory and economical service."
2. Conducted extensive field tests to gather, evaluate load and performance data.
3. Worked closely with architects and contractors to assure customer satisfaction.
4. Circulated general publicity about the heat pump among architects, contractors, builders and the public. The heat pump has been the subject of articles in its monthly magazines, Powergrams and Alabama Power News.
5. Its chief executives have expressed their enthusiastic support of heat pump promotion.

The Alabama Power Company erected the first painted, 45-foot long highway sign in the United States featuring the Heat Pump.

GENERAL ELECTRIC

HEAT PUMP

All-electric year-round air conditioner



General Electric Company, Air Conditioning Division
Sec. EW-4, Bloomfield, New Jersey

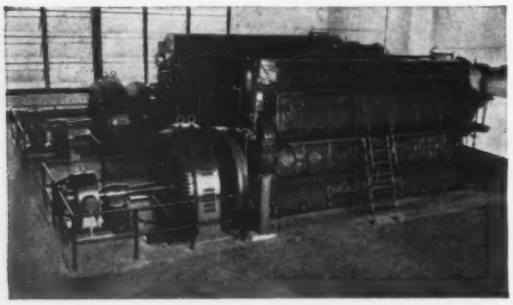
Please send me technical data on the G-E Heat Pump and information about the G-E Heat Pump Institute.

NAME AND TITLE .....

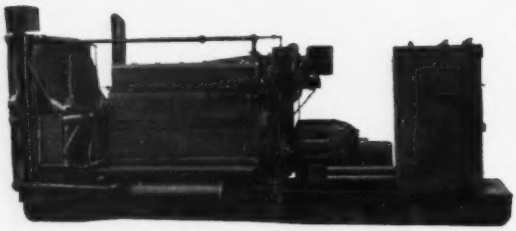
COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....



Two 1000 KW units in a Midwestern Public Utility.



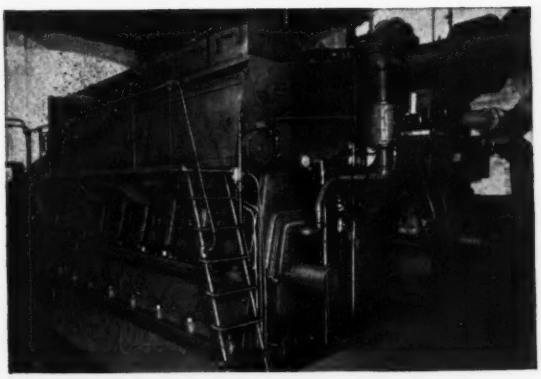
500 KW Package Unit for Utility service.

MORE POWER

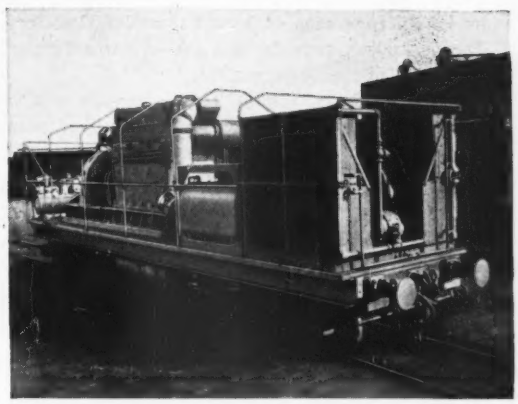
You get tops in power performance and dependability at low operating cost with CP Diesel, Dual Fuel, and Gas Engines. Efficient CP engines are available in sizes capable of delivering from 120 HP to 1750 HP and in normally aspirated or supercharged models.

Widely used for all types of service in public utilities where low cost reliable power is required, CP engines are ideally suited for emergency portable power units and for heavy duty stationary service. For more detailed information, write *Chicago Pneumatic Tool Company, 8 East 44th St., New York 17, N. Y.*

to you—at less cost



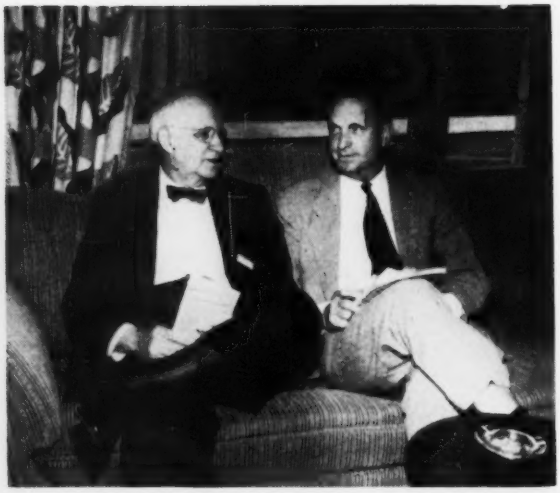
1250 KW Dual Fuel Generating Unit
in an Iowa Public Utility.



500 KW Railcar Unit for mobile service in harvesting areas, and emergency service in disaster areas.

Chicago Pneumatic

L. F. Stone, GE; Robert Doehne, Public Service E&G; C. W. Watchorn, Pennsylvania W&P, and Norman Spatz also Public Service



L. R. Lewis and B. F. Lewis, Lewis Electrical Equipment Co. L. R. Lewis was formerly president of Elpeco

AIEE Studies New Power Problems

(*Continued from page* 115)
single test wave is "perfect." P. L. Bellaschi recommended a 2 x 20 ms front for the current test wave for arresters observing that average frequency of occurence of discharge currents in station arresters falls in this range.

W. A. McMorris, General Electric, although concurring on objectives, said NEMA groups had found that an 8 x 25 ms composite current wave accurately simulates the 1½ x 40 ms voltage wave while closely approaching the present 10 x 20 ms wave. Advantage of the proposed change was not found significant and NEMA groups therefore recommended against a shorter front current wave for arrester test, he said.

Neutral grounding of two unit-connected 75,000-kva 14.4-kv generators with fault neutralizers was described by H. R. Tomlinson of New England Power Service Co. The neutralizer consists of a 100-kva transformer with a secondary side air core reactor.

E. T. B. Gross, Illinois Tech, although characterizing the resonant-grounded system as "desirable," pointed out that it cannot protect machines completely right up to the neutral.

Transmission Losses Need Evaluation

Solutions for integrated transmission system problems were presented in a series of three papers. They form a sequel to earlier material developed by E. E. George, J. B. Ward, H. Hale, G. Kron and others.

The basic philosophy of obtaining solutions of large systems by breaking them up into several parts was presented by Gabriel Kron in a paper entitled "Tensorial Analysis of Integrated Transmission Systems."

Application of the formulas developed by Kron and others for the calculation of losses in loop-interconnected systems was presented by A. F. Glimn. He showed the results of combined studies on the American Gas & Electric Co system by himself, L. K. Kirchmayer, and G. W. Stagg. The methods used make it possible to study a group of interconnected companies which could not be represented simultaneously on any conventional network analyzer.

Simplified loss calculations were presented by R. Habermann, Jr, who co-authored a paper with Glimn, Kirchmayer and Stagg entitled "Loss Formulas Made Easy," Applications of these methods have been made in studies of economic scheduling of generation, interconnected system billing, and system planning.

The significance of the papers was summed up by one comment to the effect that, "The electrical engineer has been steadily losing ground in making direct calculations of the system, and the systems are becoming so complicated it is difficult to get any answers at all. These papers are an important step toward catching up on this deficiency."

Tests Pick Puncture-Prone Insulators

A puncture test for porcelain distribution insulators that discriminates between insulators which are liable to puncture and those that flash over and continue to operate normally, was described by Bureau of Standards engineers, J. H. Park and H. N. Cones. The test, like one developed and used previously by Ohio Brass, employs eight repeated sharp-front voltage surges (7,000 kv per ms) at 20 second intervals.

In discussion J. H. Hagenguth, General Electric, noted that any insulator can be punctured by surges of sufficinetly steep front. It remains to be proved that insulator damage is due to steep front lightning, and not heat in the stroke. F. E. Andrews, Public Service Co of Northern Illinois, reported insulator surge failure similar to that experienced by REA. He urged manufacturers to pre-

(*Continued on page* 228)

NO KNOT CLUSTERS HERE!

Examine the photographs below. What you see is a 30′ Lodgepole Pine spar arm, shown in 5 sections of 6′ length. Photographs were taken at our Libby plant, before treatment, and are not retouched.

Engineers are saying:

"Lodgepole Pine* is excellent for spar arm use because of the absence of knot clusters."

*Lodgepole Pine has the strength and the mechanical life that comes from

- Slow growth
- Uniform taper
- No knot clusters

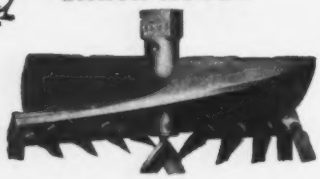
*Penta and creosote-treated Lodgepole crossarms and poles are available from our Libby plant. Literature, other information gladly furnished.

J. Neils Lumber Company

POLE DIVISION: LIBBY, MONTANA

THESE PENGO PRODUCTS SAVE YOU MONEY!

THE PENGO EARTH AUGER



- Twin helix—no back thrust!
- Bores true, clean holes in any soil, most sandstones and hardpans, frozen ground, permafrost!
- All wearing parts replaceable on job!
- Made in 22 sizes, 9" to 72" hole diameters, to fit all makes of heavy-duty earth boring machines. Larger sizes on order.

THE PENGO CUTTING HEAD

- Easy installation—welds to your present helix.
- Bores where you never could before!
- Wearing parts are replaceable on the job and are interchangeable with PENGO Auger parts. *(Described at left.)*
- Made in 11 sizes, 8" to 24" diameters. Larger sizes on order.

THE PENGO WISDOM TOOTH

- All PENGO Augers and Cutting Heads are equipped with the drive-on PENGO Wisdom Tooth, specially designed for use on earth augers; cast from special abrasion and shock-resistant steel alloy for far longer service life!

"Get the PENGO WISDOM TOOTH—It knows how to bore holes!"

SAVE HOURS . . . SAVE DOLLARS!

WITH

PENGO *Triple Flight* ANCHOR AUGERS

Especially designed to bore holes for EXPANDING ANCHORS

- Double-helix cutting head eliminates back-thrust, quickly bores true and clean.
- Triple-flight single helix carries bigger load of dirt from hole . . . you can complete a hole with less than half the trips down and up!
- Extra-long auger with small-diameter center shaft leaves plenty of room for dirt and rocks . . . no clogging or jamming!

GET THE PENGO *"Wisdom Tooth"* IT KNOWS HOW TO BORE HOLES

- Uses same fast-cutting replaceable PENGO Pilot Bits and PENGO Wisdom Teeth used on all PENGO Earth Augers and PENGO Cutting Heads.
- Available in 9", 11" and 13" diameters for 8", 10" and 12" expanding anchors, respectively, to fit all popular makes of earth-boring machines.

ORDER NOW—OR WRITE FOR FREE LITERATURE, PRICES

PETERSEN ENGINEERING CO.

MANUFACTURERS

SANTA CLARA, CALIFORNIA

Use this Handy coupon!

SEND COMPLETE LITERATURE AND PRICES ON

- ☐ PENGO earth augers
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- ☐ PENGO anchor augers

CLIP THE ATTACHED TO POSTCARD OR BUSINESS CARD

WHAT THEY'RE SAYING

At Industry's Meetings

Small Appliances are Big Business

ROBERT M. OLIVER, manager of appliance specialties Westinghouse Electric Appliance Div, before Pacific Zone, National Assn of Electrical Distributors at Pasadena, Calif.

Major appliance distributors are missing profits by avoiding the portable appliance business. Electrical distributors now have a large share of the business but can get more with intelligent specialization and selling of their many advantages.

Industry figures show that over $1.1 billion in annual retail volume is made by only 12 portable appliances. These include vacuum cleaner, mixer and blender, coffee maker, sandwich grill and waffle iron, roaster and deep-fat fryer. Steam iron business this year will be more than $70 million. Dry irons will account for $40 million more.

Key to portable and housewares business is exposure. This means selling every possible retail outlet. Every type of retail merchant is a potential outlet. Portable appliance business has a threefold claim on future volume—replacement market for high saturation products, such as electric irons; increasing saturation of products such as roasters and deep-fat fryers; and new products not yet produced.

Technology and Strength Synonymous

BRIG DAVID SARNOFF, Chairman of the Board, Radio Corp of America, before the commencement exercises at Drexel Institute of Technology at Philadelphia

America's strength and leadership must be maintained as the great outpost of freedom. Until society finds the wisdom to abolish war there is no alternative but to keep America strong enough to resist aggression, for to be adequately prepared is the surest way to discourage an attack.

Inescapably, the future of our country and of all the world is linked with technology. When science releases nuclear power and society learns to control it properly, a universal chain reaction will ensue that is bound to lift the human race to higher levels, not only material, but

Schwager-Wood Corporation

HOOKSTICK OPERATED SWITCHES

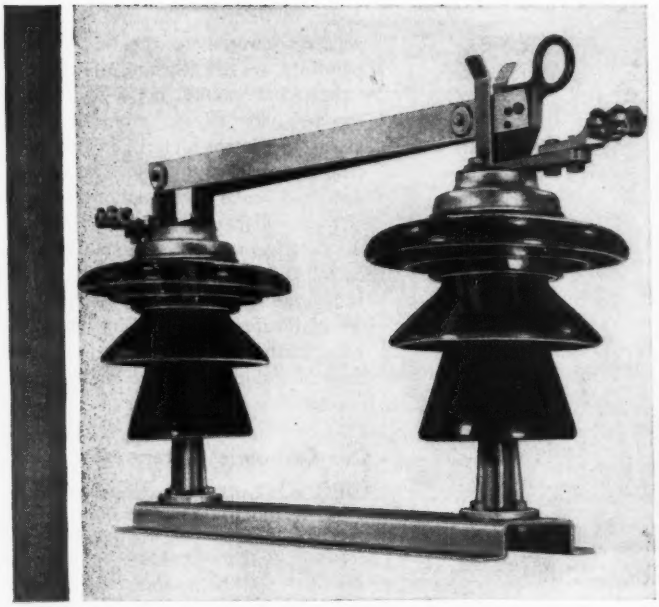
TYPE HA 7.5 KV-196 KV 400-6000 Amperes

Conforming to NEMA, ASTM and AIEE Standards

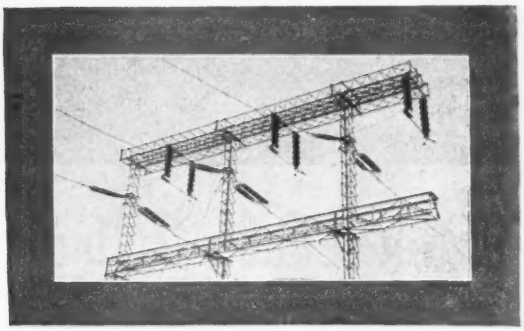
Available in all styles, including:
Single Throw • Double Throw • Tandem Transfer

POSITIVE LATCH. Incorporates an efficient pry-out mechanism with large eye and excellent leverage for easy opening even under extreme ice conditions.

SILVER TO SILVER CONTACTS for high efficiency and trouble-free operation.



A typical single pole assembly; Schwager-Wood 46 KV—600 Ampere Hookstick Operated Switch.



A 196 KV—1200 Ampere installation utilizing Schwager-Wood Hookstick Operated Switches.

SCHWAGER-WOOD CORPORATION

High Voltage Switchgear • Substation Design, Equipment • Bus Fittings, Connectors **PORTLAND, OREGON**

Technical information and prices available on request from any of our regional representatives or the home office, 8024 S.W. 35th Avenue, Portland 19, Oregon. Phone CHerry 7588

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Another new development using

B. F. Goodrich Chemical ***raw materials***

B. F. Goodrich Chemical Company does not make this cable. We supply the Geon materials for the jacket only. U. S. Army Photograph

Skinnier Cable is Stronger— Carries More Talk!

JUST think, this cable used by the Signal Corps carries 12 two-way telephone conversations at the same time, compared to 4 messages in the World War II type! On top of that, it weighs ¼ less, is ⅛ less in diameter, has better electrical properties and improved resistance to jolts, bangs and abrasion —largely due to its Geon jacket!

And here's where the taxpayer cheers. With all these improvements, it costs ⅓ less than the cable it replaces!

Spiral-4 cable is protected by an extruded jacket made of Geon vinyl materials which give it light weight, ease of handling in *all* climates and its wonderful abrasion resistance.

Credit these many advantages to Geon materials, which have helped make many products sales successes —and cut costs, too. Geon materials come in several forms—resin, plastic granules and liquid latex. They can be used for molding, coating, casting or dipping . . . are resistant to heat and cold, abrasion, oils, greases and most chemicals.

For information about Geon materials, and how they may help you improve or develop more saleable products, please write Dept. GJ-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS...the ideal team to make products easier, better and more saleable
GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

spiritual. The scientist must not paralyze his capacity for good by brooding on his capacity for evil. The fact that science has sometimes been diverted to the purposes of war is not a reflection on science but on man. I do not know a single scientist, inventor or engineer who would not rather apply his talents to the purposes of peace. I do not believe that God bestowed upon mortal man his intelligence, his ability to research, to discover, to invent and develop, in order to destroy the very things he was empowered to create. Slowly, painfully, we are learning that lesson.

Mankind cannot hope to control the behavior of the atom until he learns to control himself, in this constricted world where one man's madness can make millions mourn.

There might be an atom bomb on this platform, but it would remain harmless unless man in his confusion and desperation pulled the trigger. If the civilization we cherish is to survive, the hand that controls the atom must be guided by understanding and good will.

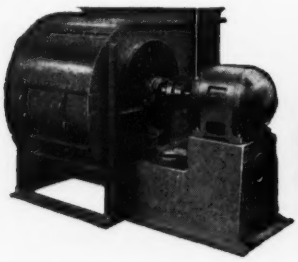
Our Economic System New

LOUIS M. STARK, manager, school service, Westinghouse Electric Corp, before graduating class of Homestead High School at Homestead, Pa.

Far from being outmoded, the American enterprise system is the newest and one of the most revolutionary systems in the world and any reference to the American system as being "old and decrepid" is untrue. It is the newest system on the face of the earth. It is a revolutionary system.

Compared with the American system, the so-called revolutionary systems of socialism and communism —the collectivist systems—are old and rickety and long since outmoded. In America, for the first time in history, the individual has been given a place of importance higher than his government. For the first time, we have a government for the people, not on top of them.

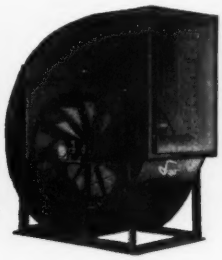
One of the most important single characteristics of American enterprise, "is that every man is free to choose the job he wants. American enterprise works best when people are interested in their work and enjoy it. That way they can perform at the peak of their abilities and contribute their best to the welfare of others."



DRAFT FANS

"Buffalo" mechanical Draft Fans are helping turn out low-cost steam in plants and major utility stations everywhere.

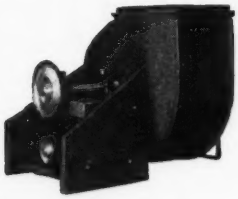
BULLETIN 3750



LIMIT-LOAD FANS

"Buffalo's" most widely used ventilating and air conditioning fans. 600 to 500,000 cfm capacities. Quiet, non-overloading, efficient.

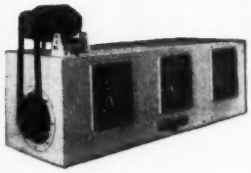
BULLETIN 3737



BELTED VENT SETS

Non-overloading ventilating fans for duct or free air delivery. Extra quiet.

BULLETIN 3720



SHORTBOY VENTILATING SETS

Quiet, efficient, vibration-free fans. Wheels mounted on hollow shaft.

BULLETIN 3701

THE FAN for your JOB IS ON THIS PAGE

"Buffalo" Fans give "extras" in performance for two reasons: First, the line is so complete that you can pick — with mathematical accuracy — the fan to give you best possible results on almost any air moving job you could name. Second is the "Q" Factor, or inbuilt quality that "Buffalo" engineers have always insisted on. Why not have us mail you Bulletins on the right fans for your air job — from the complete line shown here?

"Buffalo" FIRST FOR FANS

. . . and for satisfaction in your PUMPING applications

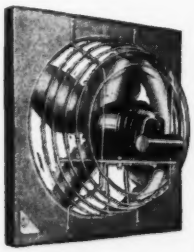
. . . check into "Buffalo" Centrifugal Pumps. Every industry depends on them. There is one to fit your hydraulic conditions. Representatives in principal cities.

BUFFALO FORGE COMPANY

212 Mortimer Street **Buffalo, N. Y.**

Publishers of FAN ENGINEERING Handbook

Sales Representatives in all Principal Cities



New! NV-BREEZO FANS

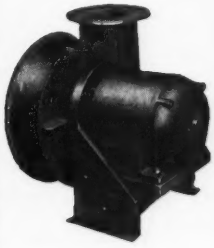
Their specially-shaped four-blade wheel gives high efficiency even against system pressures of ¼" and ½". 8" to 24" sizes.

BULLETIN 3865

New! BELT-AIR FANS

Quiet, sturdy fans to move a lot of air at negligible cost. Heavy-gauge die-stamped blades and panel.

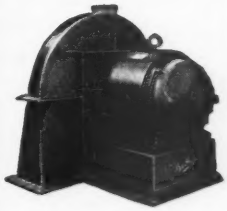
WRITE FOR BULLETIN



"CB" PRESSURE BLOWERS

Up to 2¼ psi, single stage with these husky, space-saving units!

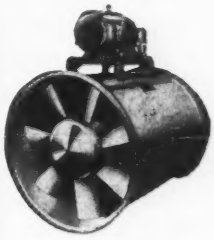
BULLETIN 3553



"CC" PRESSURE BLOWERS

In sizes for up to 4 psi, and capacities up to 75,000 cfm. Complete range of sizes, extra heavy-duty construction.

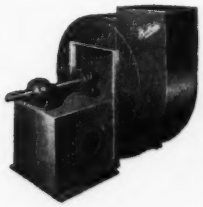
BULLETIN 3553



AXIAL FLOW FANS

Compact, light, highly efficient ventilating fans for light duty.

BULLETIN 3533



INDUSTRIAL EXHAUSTERS

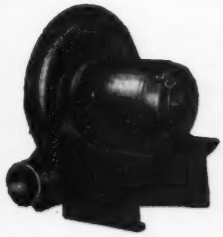
All-welded for strength and high efficiency. With air or material wheels.

BULLETIN 3576

"RE" BLOWERS - EXHAUSTERS

For pressures up to 40" of water; 50 to 1600 cfm. Furnace blowing, line boosting.

BULLETIN 3014



"E" BLOWERS - EXHAUSTERS

For low to medium pressures and volumes in draft, cleaning, line boosting.

BULLETIN 3014

BABY CONOIDAL FANS

Adjustable discharge, compact design, multi-blade rotors make these fans ideal for many small jobs.

BULLETIN 3576

VOLUME FANS

Rugged blowers-exhausters with cast iron housings and dust-proof ball bearings for any job up to 10" s.p.

BULLETIN 3615

A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

One Sure Way to Get MORE DEFENSE FOR LESS MONEY

How can we get more national defense for less money? The best answer yet given to this question appears in a little-noticed section of the new defense budget. That answer, with which this editorial is concerned, is to provide more equipment with which to step up munitions production in an emergency. Thus we can eliminate much of the need to stockpile finished munitions in advance.

The new defense budget provides an appropriation of $500 million, to be invested by the Secretary of Defense in specialized facilities required to produce munitions on a wartime scale, but not adapted to profitable operation by private industry in normal times. Facilities of this type are known as "stand-by capacity."

There is no strictly political controversy over the "stand-by capacity" program. It was originally suggested by Clay Bedford, Special Assistant to the Secretary of Defense during the Truman administration. It has since been reviewed and endorsed by the Eisenhower administration. Moreover, it involves little or no technical controversy. Civilian and military experts are well agreed that the only alternative to enormous expenditures for stockpiling military equipment is to provide enough facilities for producing it quickly in an emergency.

Here is the Key Idea

In his speech of May 19, introducing his defense budget to Congress and the nation, President Eisenhower stressed the value of such reserve capacity in these terms, ***"The more swiftly and smoothly we can mobilize, the less our dependence upon costly standing armies and navies."***

In accord with this idea, the $500 million requested for the present reserve capacity program would be invested in tools that require a long time to produce, and so present grave complications in an emergency unless they are ready in advance. Some such tools would be installed in new plants that are needed to eliminate potential bottlenecks in the defense production program. Others would be ordered to replace that part of the government's present machine-tool inventory which is made obsolete by changes in the design of defense products. By completely "tooling up" with the most modern equipment, the admin-

istration hopes to realize a production potential many times greater than could be achieved by spending the same amount of money on military end-products.

Examples of Savings

In the specialized field of defense production, adequate modern capacity is the key to both economy and speedy delivery in a pinch. Here are some striking examples from the recent report of the Advisory Committee on Production Equipment (Vance Committee) to the Director of Defense Mobilization:*

—In the case of certain ammunition components, the cost of new capacity can be recovered in only six weeks of full production.

—If $500 million worth of special tools needed to make aircraft are purchased in advance, aircraft production during the first two years of war will be increased about $18 billion. In other words, it costs 1/36 as much to acquire the tools in advance as to acquire the aircraft.

—In the case of a certain ordnance item, an expenditure equal to the cost of only 150 units of the item will provide the capacity to produce thousands and save three years' time in meeting mobilization requirements.

Moreover, reserve plants and equipment can be kept up-to-date at only a small fraction of the cost required to maintain an up-to-date reserve of military end-products. The cost of replacing 5,000 obsolete tanks is at least $1 billion. The cost of new tools for a tank plant would be less than 10% of that amount.

*This Committee, headed by Mr. Harold Vance, President of the Studebaker Corporation, included Clay Bedford, then President of Chase Aircraft, Manly Fleischman, former Defense Production Administrator, and several retired military leaders with wide experience in procurement.

Savings Will Multiply

On the basis of facts like these, the Vance Committee recommended that the Defense Department spend $500 million to $800 million per year on specialized defense production facilities in order to provide substantial reserve capacity as soon as possible. It also recommended that expenditures for military end-products which get obsolete rapidly be held to a minimum. The Eisenhower administration has adopted this approach to the problem of munitions production in asking that $500 million be invested in reserve capacity.

The importance of this approach is much greater than is indicated by the amount of money to be spent on new tools, although this amount will go far toward assuring a healthy machine tool industry, adequate to meet emergency demands. ***What is really important is the great saving that can eventually be made in the cost of our defense program by a modern tooling program.*** If we are to maintain this program for a long period, and if we are to pay as we go, we must have a low-cost program. No other plan to reduce and control the cost of a garrison economy can compare with the new approach suggested in the Vance Report and now embodied in the new defense budget.

Congressmen will do well to scrutinize all military appropriations carefully. They have a chronic tendency to be too big. But there should be no penny-pinching on investments in capital equipment that will pay out in as short a time as six weeks in a war emergency. It would be tragic if this opportunity for real economy were lost in the controversy over other aspects of the defense program. ***The tooling program is a key part of the Eisenhower effort to cut defense costs. It should be promptly approved.***

McGraw-Hill Publishing Company, Inc.

Naughton Promoted to VP. . .

. . . and general manager of Utah P&L. Gadsby is elected chairman of board to succeed Hanchett, who is retiring

With retirement of Lafayette Hanchett as chairman of the board, Utah Power & Light Co has announced these changes:

George N. Gadsby, president and general manager, was elected chairman of the board to replace Hanchett. Gadsby, who remains as president, has relinquished the position of general manager. E. M. Naughton, assistant general manager, was elevated to vice president and general manager.

E. M. NAUGHTON

VP of Nelpa . . . Associated with Utah P&L since 1935, Naughton has served as assistant general manager since 1950. Before joining the Utah utility, he spent ten years with Texas Power & Light Co. He was recently elected second vice president of Northwest Electric Light & Power Association (EW, June 29, p 147).

Gadsby, a former president of Nelpa, was named president and general manager of Utah P&L in 1929. Hanchett, board chairman of Utah P&L since 1929, retires after 34 years service with the utility.

Grayson Heads California Unit

LAUREN W. GRAYSON

Lauren W. Grayson, chief engineer and general manager of the Glendale (Calif.) Public Service Department, has been elected president of the California Municipal Utilities Association. Grayson, formerly vice president of the association, succeeds Clifford E. Plummer, chief engineer, Modesto Irrigation District. The group also elected Carl Richey, assistant general manager, Sacramento Municipal Utility District, vice president for the next two years.

Before assuming the Glendale posts in 1951, Grayson was chief engineer and general manager in the Riverside Public Utilities Department for nine years.

•

Lewis Hollingsworth, manager at Slaton, Tex., for Southwestern Public Service Co since 1949, has been appointed utilization manager for the Plains Division of the utility. Hollingsworth, who started with the company in 1938, replaces **Earl Lewis,** who is being promoted to the utility's Amarillo office to take over supervision of agricultural activities of Southwestern PS' service area. **Melvin Kunkel,** with the utility since 1950, succeeds Hollingsworth as Slaton manager.

Kenneth D. Kroggel, assistant regulation engineer for Toledo Edison Co since 1950, has been advanced to regulation engineer.

Washington Water Power Reveals Personnel Changes

Changes in its general office organization and new appointments in division managerships have been announced by Washington Water Power Co.

Kimball I. Jack, former head of the firm's advertising and publicity department, was named manager of a newly formed general sales, promotion and information department designed to coordinate public and employee information and sales programs.

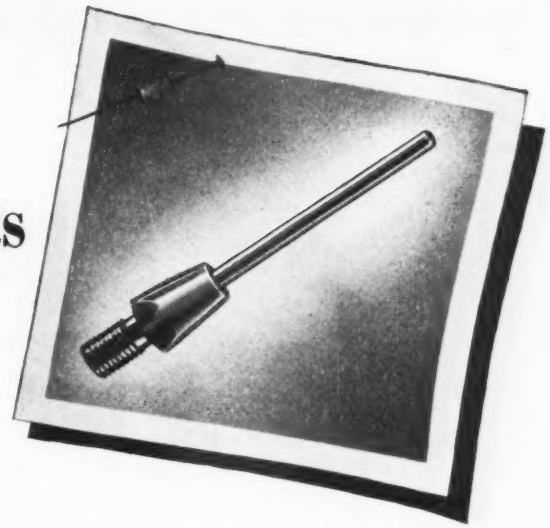
The WWP production plant maintenance and construction department has been consolidated with the power supply department under Marshall L. Blair, chief of system operation.

Continues as Consultant . . . James S. McNair, a company veteran of 31 years who has headed the production department since 1943, will continue as production consultant.

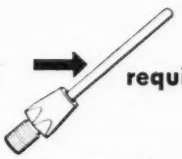
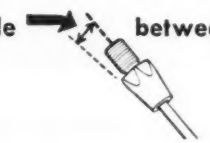
The title of transmission and distribution has been abandoned in favor of "engineering department," with its former superintendent, Lester R. Gamble, being named chief engineer. Engineering functions in other departments are being consolidated under his new department as are activities of easement and rights-of-way acquiring, formerly under the WWP secretarial department.

J. A. Riner, purchasing agent, is to assume the management of the stores and transportation sections in addition to purchasing. Carl E. Gieseker, treasurer of the company, has been given responsibility for the general accounting department, following recent retirement of W. F. Miller,

To Reduce Your Contact Assembly Costs



Use the same specialized experience that solved this problem . . .

This tungsten electrode  **requires grinding to a tolerance of ±.00025 of an inch to insure absolute concentricity. This braze** **must withstand the centrifugal forces of the highspeed generator in which it is mounted. The hole in the chuck** **is held to a tolerance of ±.00025 of an inch. This angle**  **between the chuck and electrode is held to within ±6 minutes of a degree.**

Originally Mallory produced only the tungsten electrode for this assembly. Another firm manufactured the chuck, and a third did the brazing and chrome plating... a complicated, costly process. Now, Mallory produces the entire assembly. The customer's problems of quality control, sub-contracting and divided responsibility are entirely eliminated . . . and his costs are lower.

This is just one more example of how many manufacturers have improved the performance and lowered the cost of contact assemblies by having Mallory do the entire job. No matter what your requirements are, Mallory's specialized production facilities . . . experience in designing and mass-producing over 5000 different types of contacts . . . can turn out precision contact assemblies for you at lower cost.

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SERVING INDUSTRY WITH THESE PRODUCTS:

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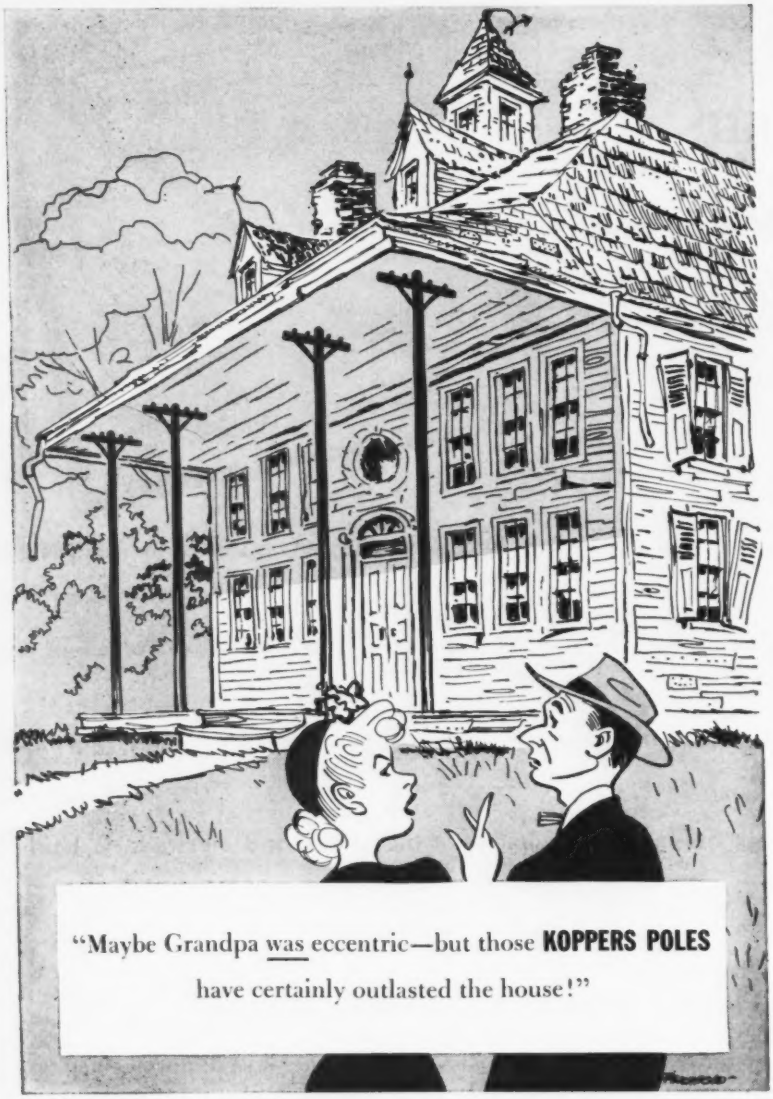

● Grandpa was pretty smart, after all. He *knew* that creosoted wood far outlasts ordinary wood.

By lasting so long, Koppers Pressure-Creosoted Poles give utility companies the kind of service they like . . . the kind of service that shows up on the profit side of the ledger.

Koppers Poles cut maintenance and replacement costs. They make line operation better and more economical. Specify Koppers Full-Length Pressure-Creosoted Poles. Quotations given on request.

KOPPERS

KOPPERS COMPANY, INC.
WOOD PRESERVING DIVISION
PITTSBURGH 19, PENNSYLVANIA

PRESSURE-CREOSOTED WOOD

comptroller. Roy P. Moller of the accounting staff has been designated as employment and employee welfare supervisor.

Departmental name changes also included designation of the former rate and economic research department as the "rate and contract department," designating the expanded operation being carried on by its manager, Arthur H. Wegner.

Appointment of J. Harry Lucas, Lewiston Division manager since 1948, as Spokane Division manager, culminates preparations to re-establish a completely separate divisional operation in Spokane. Albert Gruber, industrial development manager for WWP, will succeed Lucas in the Lewiston area post.

Victor S. Casebolt, manager of the Moscow, Idaho, district, has been named manager of the Palouse Division of the company with headquarters in Pullman, Wash. Casebolt, who has been in company service 29 years, will succeed J. D. Lewis, who is retiring after nearly 43 years with WWP. Lewis has accepted a position with Ebasco Services, Inc., in Greece.

The Coeur d'Alene Mining Division has been consolidated with the Coeur d'Alene Division, whose manager, L. R. Wood, will announce a manager for the mining district at a later date.

Get New Assignments

Sylvania Electric Products, Inc, has appointed E. Finley Carter as vice president and technical director of the company and Howard L. Richardson as vice president in charge of engineering operations. Carter served as vice president in charge of industrial relations for a year before becoming in 1945 vice president in charge of engineering, a post he filled until the present assignment. He will furnish technical counsel to Sylvania's management and engineering groups. Richardson, vice president in charge of industrial relations since 1951, assumes the operating responsibilities previously held by Carter as vice president in charge of engineering.

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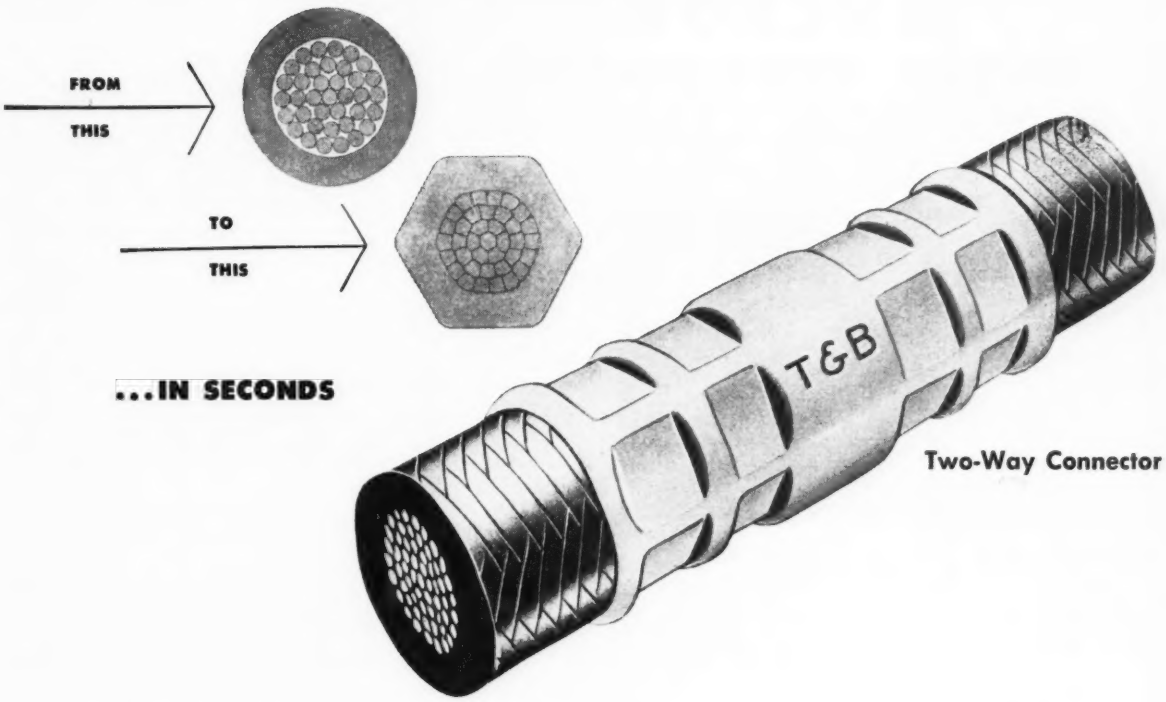
Albert H. Borchardt, vice president of Worthington Corp, has retired after 44 years' service with the firm. When Borchardt was appointed vice presi-

T & B METHOD



THE STRONGEST CONNECTION FOR ALUMINUM OR COPPER CABLE

T & B METHOD two-way connectors form exceptionally tight butt splices that develop tensile strengths far in excess of National Electric Code requirements. Uniform all-around compression of T & B METHOD two-way connectors assures maximum contact and minimum current loss. A slight taper at the compression end of the fitting helps prevent damage to strands due to flexing and vibration.

The hardened steel dies of a light-weight, portable T & B hydraulic tool compress around the joint with tremendous hexagonal pressures and force the fitting and cable into one homogeneous mass . . . all in a few seconds.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD *aluminum* connections, no joint compounds are needed to obtain maximum electrical efficiency. For *copper* connections, no special cable treatment is required. T & B METHOD fittings for aluminum have fine serrations inside the barrel which, during compression, penetrate the insulating film of aluminum oxide on the outside cable strands. At the same time, the oxide film on the inner cable strands is effectively abraded, thereby maintaining a dense, tight joint of high conductivity.

Investigate the complete line of T & B fittings for aluminum and copper cable – they offer you savings in time and installation costs. Write for your free copy of T & B Bulletin #67.

LOOK FOR THIS SIGN –

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T31

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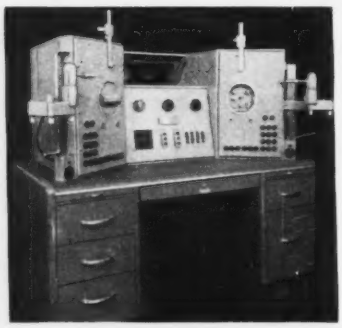
for 1, 2 or 3 Elements—"A" Base or "S" Base
WATTHOUR METERS
Voltage Ratings—120, 240 and 480 Volts

FULL LOAD AMPS.	LIGHT LOAD AMPS.
2.5	0.25
5	0.50
10	1.0
15	1.5
25	2.5
30	3.0
50	5.0



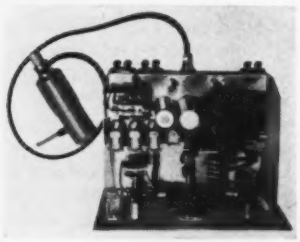
NO FOCUSED LIGHT BEAM REQUIRED.
Anchor Type DMT Meter Test Panels, illustrated above, have two mountings for meters under test, each equipped with Anchor patented photoelectric revolution counter carried on adjustable arms. These do not require focused light source AND CONSEQUENTLY ARE READILY ADJUSTABLE TO ALL TYPES OF METERS.

AUTOMATIC SEQUENCE TESTING.
This equipment *automatically runs the full load, power factor and light load tests in sequence,* or anyone of these tests runs may be selected at will.

PUSH BUTTON REVOLUTION SELECTION.
A choice of 12 different numbers of revolutions is provided by means of push buttons. All controls are located on central panel arranged in logical sequence for convenience of operator. The equipment automatically resets itself at the end of each run, but may also be manually reset during a run if desired.

Also Available
PHOTOELECTRIC REVOLUTION COUNTER AND CONTROL RELAY.

Front View—Closed



Top View—Open

These units, duplicating various features of the Type DMT Panels above, are for the purpose of modernizing existing meter test panels. They are portable, bench mounting type. Furnished with or without adjustable mounting arms for the photo-electric pick-up head.

ANCHOR
MANUFACTURING CO.
MANCHESTER, N. H.
TRADE MARK REG.

dent in 1951, he assumed overall responsibility for sale of the corporation's entire line of pumping equipment.

Elects 4 Vice Presidents

Thor Power Tool Co, Aurora, Ill., has elected four new vice presidents. J. A. Hill, with the company for 33 years, was elected vice president and sales manager. John A. McGuire, who retains the title of chairman of the executive committee, becomes vice president in charge of labor relations. After serving in various sales posts for 27 years, B. H. Johns was made vice president in charge of rock drill sales. W. B. Hunn, with Thor for 18 years, was appointed vice president in charge of the company's Los Angeles Works.

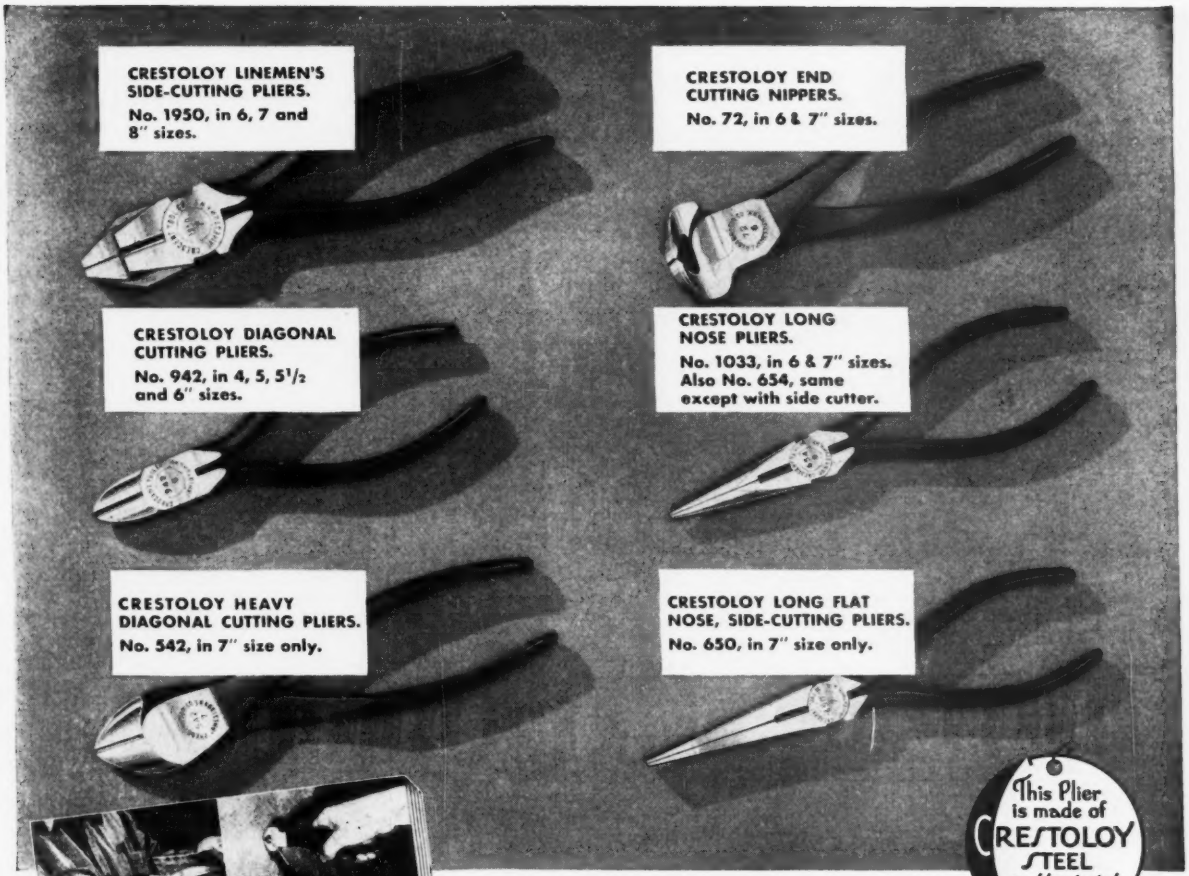
•

Frank X. Gilg has been named an executive assistant in the Boiler Division of Babcock & Wilcox Co. Gilg, who joined B&W in 1922, was made an application engineer in 1948. B&W also appointed **W. Tom Moore** an executive assistant in its Atomic Power Division. Moore, who began with the firm in 1926, has been engaged in atomic power development for B&W for the past two years.

Charles F. Monson has been promoted from assistant to superintendent of system operations for Puget Sound Power & Light Co to succeed **Wiltse Mathis,** who has retired. With the company for the past 14 years, Monson was named assistant operating superintendent in 1949.

Wilmot O. Smith, formerly electric operating manager for Long Island Lighting Co, has been elected assistant vice president in charge of electric operations. The utility also advanced **Samuel A. Horsfield** from gas operating manager to assistant vice president in charge of gas operations.

Clyde H. Spencer, who has served as construction engineer at Hungry Horse Dam, Mont., for the Bureau of Reclamation since 1947, has been appointed head of the bureau's Region 2 office in Sacramento, Calif., which is now known as the California Projects Office. Spencer, whose title is supervising engineer, replaces Richard L. Boke, who retired July 1


CRESTOLOY LINEMEN'S SIDE-CUTTING PLIERS.
No. 1950, in 6, 7 and 8" sizes.
CRESTOLOY END CUTTING NIPPERS.
No. 72, in 6 & 7" sizes.
CRESTOLOY DIAGONAL CUTTING PLIERS.
No. 942, in 4, 5, 5½ and 6" sizes.
CRESTOLOY LONG NOSE PLIERS.
No. 1033, in 6 & 7" sizes. Also No. 654, same except with side cutter.
CRESTOLOY HEAVY DIAGONAL CUTTING PLIERS.
No. 542, in 7" size only.
CRESTOLOY LONG FLAT NOSE, SIDE-CUTTING PLIERS.
No. 650, in 7" size only.
This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily

CRESTOLOY PLIERS

are individually tested!

Crestoloy Pliers take all the guesswork out of plier buying, because Crescent has taken all the guesswork out of plier making. Rigid specifications establish the material, design, workmanship, tests and inspection of these better tools. Strict adherence to these specifications is maintained by continuous tests and relentless inspection of the *individual* tools. Every plier carries the Crestoloy tag certifying that it has been individually tested.

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This new 20-page booklet provides many useful how-to-do-it ideas both for amateurs and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. 93 illustrations. Write today.

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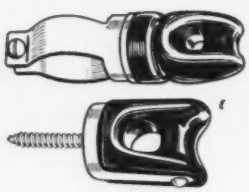
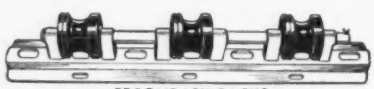
The most complete line of quality secondary service materials available

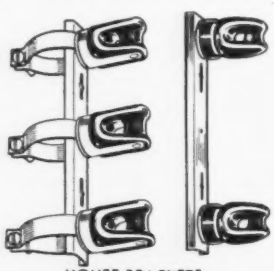
Every design conforms with industry standards. Racks and house brackets are double hot-dip galvanized for longer service. Wireholder screws are sharp and clean, for quick, easy driving. Dense, homogenous porcelain gives top strength, highest insulation value and sparkling appearance. Your lineman and your budget will like the ease of installation—and the quality—of Porcelain Products' secondary service materials. Write us for complete details.



WIREHOLDERS
Standard and pipe-mounting



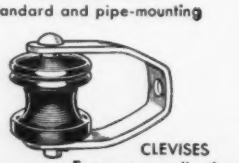
SECONDARY RACKS
Solidly constructed for longer service



HOUSE BRACKETS
Standard and pipe-mounting

FOUR-IN-ONE SPOOLS
A wonderful new product

SPOOLS



CLEVISES
For every application

Porcelain Products, Inc.
FINDLAY, OHIO

as director of Region 2 (EW, June 29, p 147). Spencer joined Reclamation in 1919.

E. N. Allenbaugh, City Light superintendent at Ellensburg, Wash., has been named superintendent of public utilities, a post created to consolidate operations of the municipal light and water departments.

OBITUARY

George S. Williams

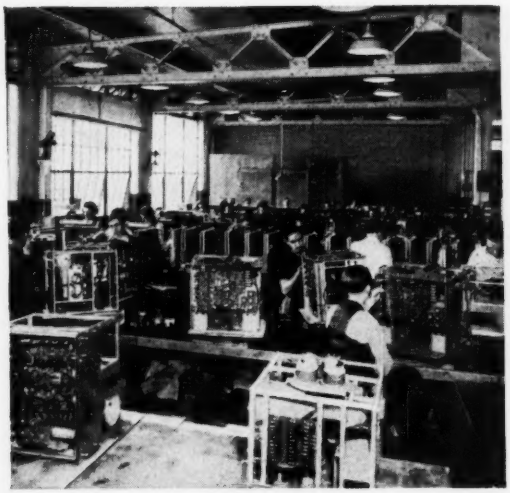
George S. Williams, 72, who retired last October as executive vice president of Central Maine Power Co, died recently.

A pioneer in the development of electric utility service in central Maine, Williams started with Kennebec Light & Heat Co, a predecessor of Central Maine Power, almost 50 years ago. He was made general superintendent in 1917, vice president and general manager, and a director in 1926, and executive vice president in 1947.

Williams, a son of the late Col. W. H. Williams, a co-founder of the Kennebec L & H, merged with Central Maine in 1910, had continued in a consulting capacity with Central Maine Power after his retirement.

George L. Munroe, for 25 years rural service engineer for Narragansett Electric Co, Providence, R. I., until his retirement in 1950, died June 21 at Cranston, R. I.

George W. Mapother, New England district representative for Murray Manufacturing Corp, Brooklyn, N. Y., for the past 20 years, died June 8.



INDUSTRIAL RELATIONS plays an important role in today's business scene. A well-planned program of job evaluation can result in better employee relations and improved production. One job evaluation study Ebasco recently completed was for an Eastern electronics company.

HOW SPECIALIZED SERVICES GO TO WORK FOR BUSINESS AND INDUSTRY

Ebasco engineers, constructors, and business consultants are right at home in this age of specialization. They render services to companies in many different fields . . . devote their talents to assisting these companies when special problems arise.

Throughout the United States and in many countries Ebasco undertakes diversified projects like those presented on this page for companies of all sizes, for long-established firms and new businesses.

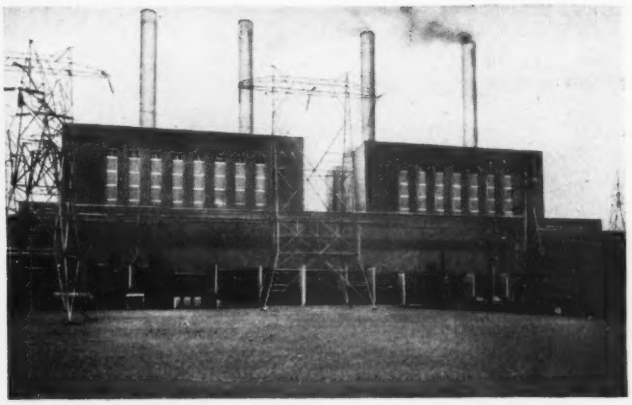
It is very possible that Ebasco may be able to serve *you*. Our booklet, "The Inside Story of Outside Help," describes the full range of services we offer business and industry. May we send you a copy? Just write or phone Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

NEW YORK • **CHICAGO** • **WASHINGTON, D. C.**

Appraisal · Budget · Business Studies · Consulting Engineering · Design & Construction · Financial · Industrial Relations · Inspection & Expediting · Insurance, Pensions and Safety · Purchasing · Rates & Pricing · Research · Sales & Public Relations · Space Planning · Systems & Methods · Tax · Traffic · Washington Office

Ebasco Teamwork gets things done anywhere in the world

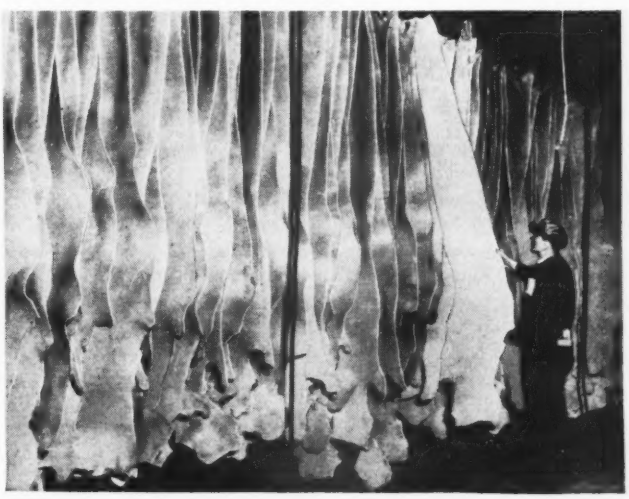


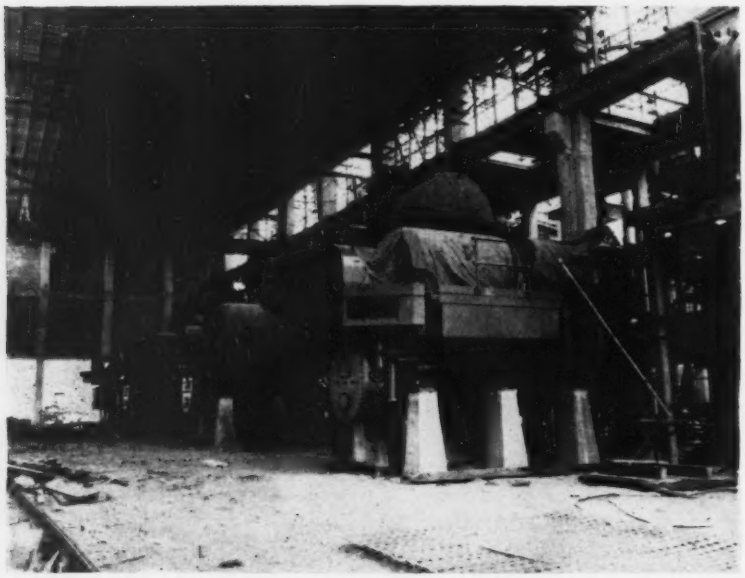
DESIGN AND CONSTRUCTION services are in constant demand by electric companies which provide dependable electric service throughout America. Ebasco handled the design and construction of the 375,000 KW Sunbury Steam Electric Station, shown above, for Pennsylvania Power & Light Co.

PENSION and retirement plans help attract new employees to a company and hold present ones. That's why more and more firms are installing them. Ebasco has prepared pension programs for many prominent companies in many different fields.

MARKET STUDIES are used by business and industry to provide a blueprint for sales and marketing programs. One such study made by Ebasco was of the effervescent teenage market—for one of the nation's largest manufacturers of soft drinks.

ENGINEERING SURVEYS often enable companies to reduce their production costs. Ebasco's engineering recommendations to a leather processing company, for example, resulted in abandonment of outgrown power facilities which were costly in manpower and space, and inefficient in the production of steam and electric power. This move produced annual savings many times greater than the cost of the survey.





Supplies "Packaged" Power Plants

Westinghouse Electric International Corp's "packaged" power plants are being installed in the Australian State of Victoria. The units are completely prefabricated and standardized.

Generating plant shown above is at erecting stage at the new American-made, two-packaged steam-electric power station which the State Electricity Commission of Victoria is now building under contract at Ballarat. Four generating sets, each of 5,000 kw, are being installed. The first of these is scheduled to begin generating this month.

Co-ops' Aluminum Contracts . . .

. . . with Wisconsin Electric Cooperative and Reynolds Metals no longer will be enforced by REA

Rural Electrification Administration has given up policing a 1949 purchase deal under which some 250 REA borrowers were committed to rely on a single supplier for aluminum conductor needs.

REA Administrator Ancher Nelsen in a recent letter to co-ops participating in the deal said his agency would leave contract compliance up to individual borrowers.

This was a complete turn-about from the attitude of the former Democratic Administration. Just before Nelsen took over in May, REA had pointedly told affected co-ops to continue to honor their exclusive purchase contracts.

No Recrimination . . . Effect of the Republican action is to withdraw threat of REA recriminations against borrowers who may interpret their aluminum purchase contracts differently from the former REA view. Enforcement of the contracts, it now appears, is left up to the supplier, Wisconsin Electric Cooperative, and the manufacturer, Reynolds Metals Co.

At recent conferences in Washington both Reynolds and WEC protested Nelsen's letter. They hoped last week that the REA administrator would modify his stand to assume part responsibility for enforcing the contracts.

In at least one case, the WEC-Reynolds contract has been interpreted to forbid an individual co-op from placing an order with another supplier which offered conductor at cheaper prices. In that case the Border Counties Power Co-op of Warroad, Minn., canceled a tentative order it had placed with Bergstrom-Verbarg Co of Minneapolis due to the previous contract with WEC-Reynolds.

Deal Announced in '49 . . . The exclusive purchase contract deal was announced early in 1949 as aluminum conductor shortages plagued the rural electric co-op program. The idea was to establish a reliable source of aluminum conductor for the co-ops and several public power bodies.

WEC entered negotiations with Reynolds to supply the conductor. Aided by the National Rural Electric Cooperative Association, WEC also recruited some 250 co-ops to enter into contracts to buy conductor exclusively from WEC. A minimum advance payment of some $6 million was required by Reynolds to undertake the stranding operations.

This minimum was subsequently reduced and contracts were finally negotiated.

Distribution co-ops who signed contracts promised to fill aluminum conductor needs through Wisconsin Electric-Reynolds channels, except that existing purchase contracts would be allowed to run their course.

Presumably the WEC contracts covered a base period of three years for which a specified amount of aluminum was to be purchased by the individual co-ops and an additional five-year period for which there were no estimated needs by the individual co-ops.

Although REA was not a party to these contracts, it did specify their form and approve them as the procurement contracts of individual co-ops. Under an REA reorganization last summer, the agency decided to relinquish consideration of individual procurement contracts, leaving them up to co-op discretion.

This decision was later modified to provide that REA would have to approve any departure from the WEC-Reynolds contracts which individual borrowers proposed.

"I can vouch for Dodge stamina and maneuverability"

Why new DODGE *"Job-Rated"* TRUCKS are *ideal* for public utilities

Fast and lively on the go!

Seven brawny engines . . . from 100 to 171 h.p. . . . three of them *all-new*. You can be sure the Dodge you choose will deliver all the power you need—and *then* some! And when it comes to handling, you can turn tighter, park easier, wheel around with less effort, thanks to short wheelbases and wide treads. What's more, new no-shift Truck-o-matic transmission *does your gearshifting for you* . . . saves extra energy for the work at hand! Available on all ½- and ¾-ton models.

Running costs stay mighty low!

Just buy a Dodge *"Job-Rated"* truck and watch those operating and upkeep costs go down. Chrome-plated top rings, 4-ring pistons and high compression ratios help limit your gas and oil bills. *"Job-Rated"* design means your Dodge will last longer with less time out for repairs. Find out about the more than fifty new features from your friendly Dodge *"Job-Rated"* truck dealer. You'll discover that your time is profitably invested.

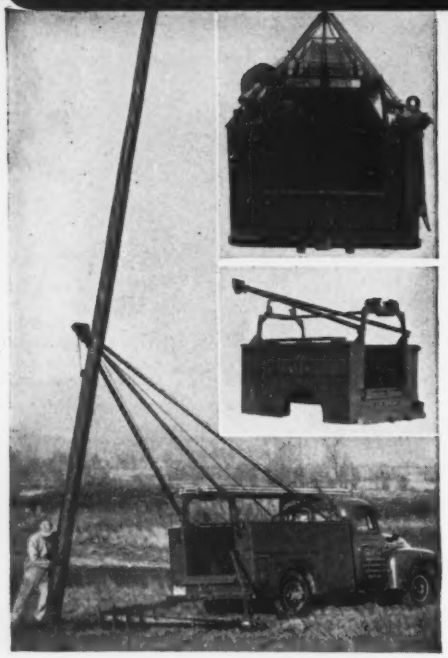
. . . *says* **JOHN J. DOYLE,**
Street Commissioner, Scarsdale, N. Y.

"Public utility trucks must be ready to go, night and day, on any kind of routine job or emergency. For routine work, we demand continuously high performance and economy . . . while for emergency calls, the watchword for our utility trucks is complete dependability under all conditions. We find that Dodge *'Job-Rated'* trucks answer our requirements to perfection!

"The stamina and high degree of maneuverability of these units are put to the test daily in our public utility work, and I can vouch for the fact that our Dodge *'Job-Rated'* trucks pass with flying colors. We feel that they are excellent all-round units!"

DODGE
"Job-Rated" TRUCKS

Two-Man
COMBINATION TRUCKS
Pay Dividends



With a ¾ or 1-ton truck and Tel-E-Lect "Combination" Body, you can . . .

- Dig holes and set poles up to 40'
- Handle your regular service work
- Reach a variety of jobs quicker
- Operate with two men at less cost

IT'S A COMPLETE PACKAGE, tailored for your make and model of truck. Derrick, winch and digger drive are all assembled to the body, ready for your truck chassis. Easily mounted in a few hours by your local mechanic.

Write for Bulletin

TEL-E-LECT
PRODUCTS, Inc.
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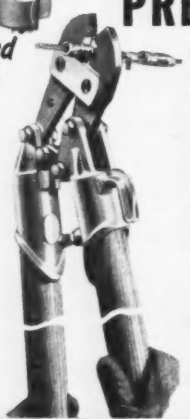
CLAMP-to-CLAMP CONTACT
AVOIDS
CONDUCTOR PITTING
with this
KEARNEY
PRESSUR-TAP CLAMP

Easily Installed on Energized Lines with Pressur-Tap Installing Tools



The permanent, high-conductivity taps made with Pressur-Tap Clamps cannot possibly cause conductor pitting. Any arcing will occur between clamp halves. For this reason Pressur-Tap Clamps are especially recommended for installation beyond the armor rods. Clamps are made of aluminum and are plated for use with any type or combination of aluminum or copper conductors.

Specify KEARNEY PRODUCTS

JAMES R. KEARNEY CORPORATION
ST. LOUIS, MO. GUELPH, ONT.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Mo. -226

For Better Construction - For Safer Maintenance

Wise's Letter . . . In letters dated April 27, 28, and 29, Deputy Administrator William C. Wise, then acting administrator, wrote the participating co-ops:

". . . These contracts provide that during this five-year period the borrower shall purchase from WEC its total requirements of ACSR conductor. Purchase of ACSR conductor from any other supplier during this period would be a violation of the contract. You, of course, understand that loan funds must be spent in accordance with the borrowers' approved contracts. REA is also concerned in the matter from the standpoint of loan security, since violation of the contract could lead to legal action by the materialman or manufacturer against the borrowers involved."

Nelsen Policy . . . The Nelsen letter of June 10 flatly rescinded the Wise letter. In its place, the new administrator announced these policies:

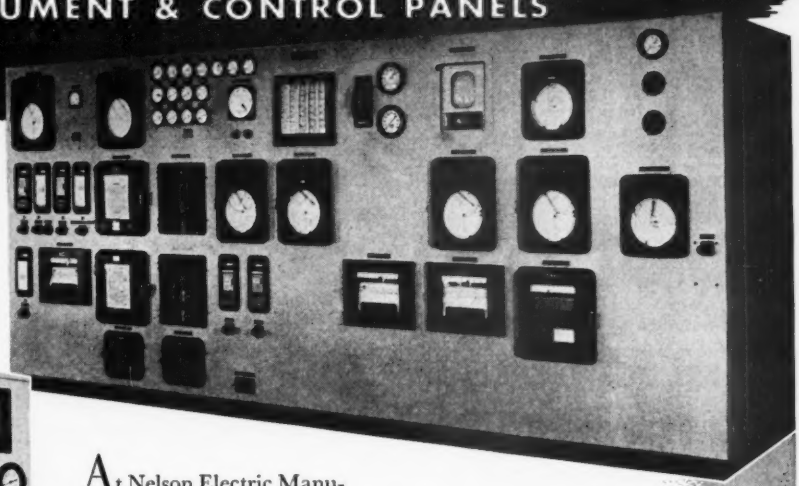
1. "It is the responsibility of the board of directors of each REA borrower to consider all applicable circumstances and to make its own decision in respect of the placement of orders for conductor or other materials—uninfluenced by REA." (REA approvals are of course required in respect to construction, materials standards, and effect upon feasibility of the REA loan.)

2. "In reaching such decision it is anticipated that the board of directors will give due regard to existing contractual commitments which the borrower may have; REA, however, will not be in the position of interpreting the scope, effect, or validity of existing contracts or provisions thereof. These are matters for consideration of the borrower's attorney, or for negotiations between parties, or in the event of litigation, for determination by the courts."

MANUFACTURING BRIEFS

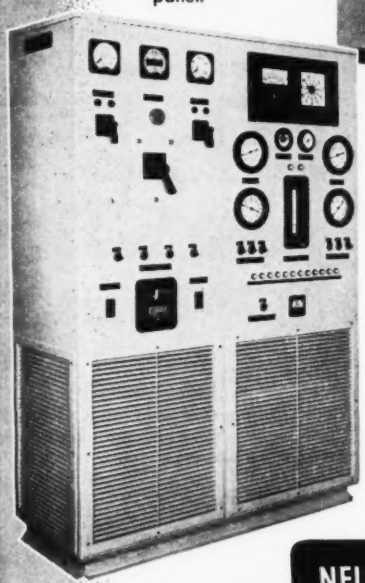
Worthington Corp, Harrison, N. J., has received a 22-year loan of $25 million from a financial institution whose name was not revealed. The corporation will use $10,750,000 of the loan to finance an expanded volume of sales and to increase its investment in plant and equipment in the air-conditioning field.

CUSTOM-BUILT
INSTRUMENT & CONTROL PANELS

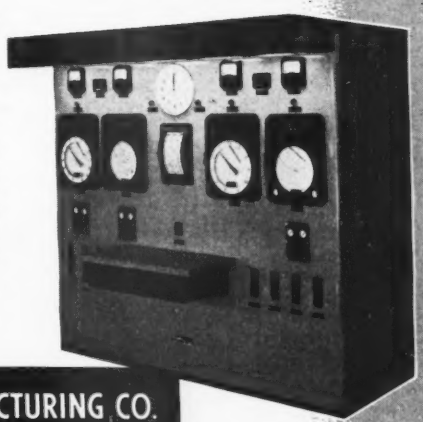


▶ Piped and wired instrument and control panel for power plant.

▼ Engine control panel.



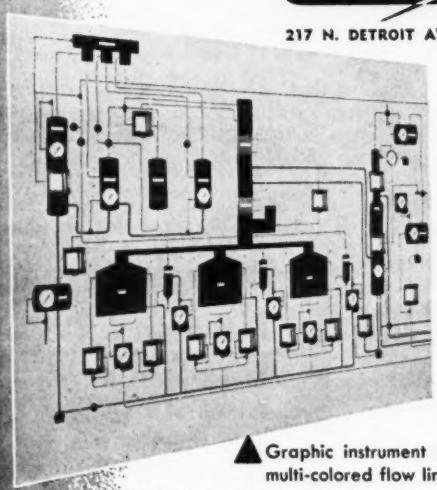
At Nelson Electric Manufacturing Company, engineering know-how and manufacturing skill are utilized in producing custom-built instrument and control panels that meet, in every detail, each customer's requirements. We do all of the design work (if you desire), all fabricating, all wiring, all piping and all testing. Let us quote on your requirements.



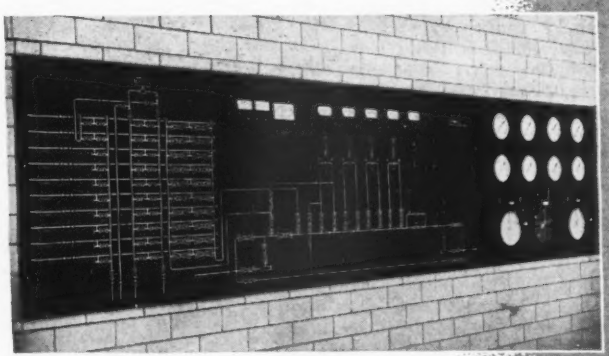
NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

217 N. DETROIT AVE. TELEPHONE 2-5131

▲ Pressurized piped and wired cubicle for kiln control.

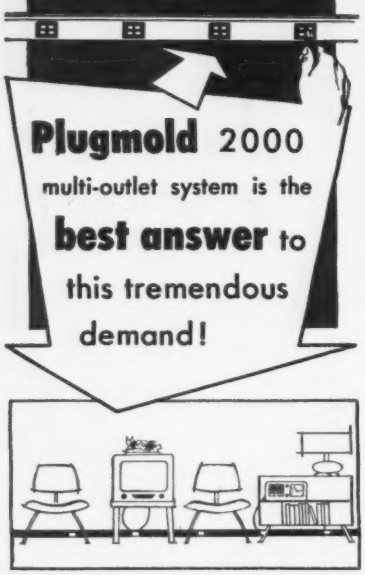


▲ Graphic instrument panel with multi-colored flow lines.



▲ Control panel installed in products pipe line station.

All over the country people **want** more outlets!



Home-buyers — and present owners — are insisting on more outlets! Factories everywhere want more power outlets right at work benches. Offices, hospitals, schools need more outlets.

This nationwide demand is a multi-billion dollar market—even when cut down to size in your own town, it is tremendous! And it's there . . . right now.

Plugmold 2000 is the fastest, easiest, cheapest way you can provide multiple convenience outlets. If you aren't working with Plugmold now, write today for full information. Better yet—order the 20-foot Introductory Package from your distributor.

PLUGMOLD is guaranteed, like all Wiremold products. You'll find this firm guarantee on page 7 of Wiremold's Catalog No. 19.

WIREMOLD

Makers of
PLUGMOLD—multi-outlet systems
WIREMOLD—electrical raceways
PANCAKE—overfloor raceways

THE WIREMOLD COMPANY
HARTFORD 10, CONN.

Hevi Duty Electric Co, Milwaukee, has asked Securities and Exchange Commission approval to purchase 15,645 shares of stock of Anchor Manufacturing Co, Boston, which manufactures and sells electrical devices, including meter sockets, transformer cabinets, and central station meter testing panels.

RCA Victor Division of Radio Corp or America has purchased ground to construct a new plant at Findlay, Ohio, for manufacture of electronic component parts for radio and TV home receivers. Plans call for construction of a single-storied structure providing about 150,000 sq ft of floor space. First unit of the new facilities is expected to be in operation in the spring of next year.

Sprague Electric Co, North Adams, Mass., plans to construct a new plant near West Jefferson, Ashe County, N. C., for the manufacture of capacitors. The 50,000-sq ft plant, which will employ about 250 workers when it reaches full schedule production, will be situated on a 30-acre tract on a bend of the New River. The plant expects to start operation Nov. 1.

SALES ASSIGNMENTS

COMPANY STAFFS

Moloney Electric Co has promoted James A. Johnson from its advertising staff to field representative with headquarters in Dallas, Tex.

Ward Leonard Electric Co, Mt Vernon, N. Y., has placed Leonard H. Wurzel in charge of its recently established Pittsburgh district office at 3045 W. Liberty Ave.

MEETINGS CALENDAR

Electrical Equipment Representatives Association
Summer Meeting, Hotel Colorado, Glenwood Springs, Colo., July 15-17.

International Association of Electrical Leagues
18th Annual Meeting, Fairmount Hotel, San Francisco, Aug. 5-8.

American Institute of Electrical Engineers
Pacific General Meeting, Hotel Vancouver, Vancouver, B. C., Sept. 1-4; Middle-Eastern District Meeting, Daniel Boone Hotel, Charleston, W. Va., Sept. 29-Oct. 1; Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

Illuminating Engineering Society
National Technical Conference, Hotel

Only PLUGMOLD 2000 gives you SWITCHED and HOT OUTLETS in the SAME Receptacle!

WIREMOLD's exclusive SNAPICOIL eliminates multiple connections between short lengths – receptacles are pre-wired in 50 foot coils.

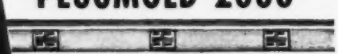
The Snapicoil 3-wire duplex receptacles of the new Plugmold 2000 multi-outlet system have one side *switched* and one side "*hot*"—this exclusive Plugmold feature means *extra* convenience in homes, stores, offices . . . everywhere.

The same size Plugmold 2000 raceway also accepts Snapicoil 2-wire duplex all "hot" or NEMA 2-wire grounded receptacles. Only *one size raceway* is needed on the job!

Plugmold 2000 is easier, faster and cheaper to install!

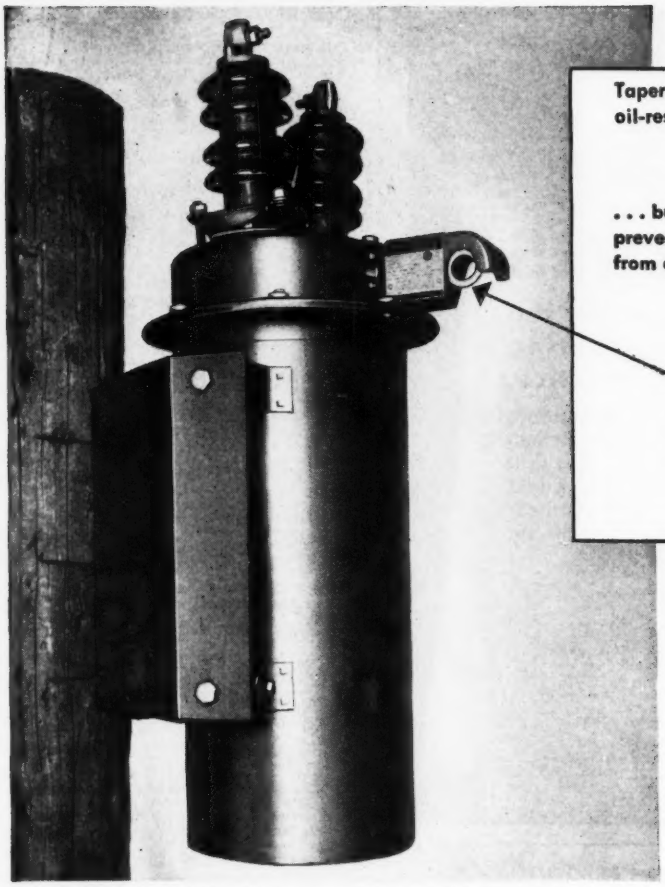
Write today for the new, free Plugmold 2000 book!

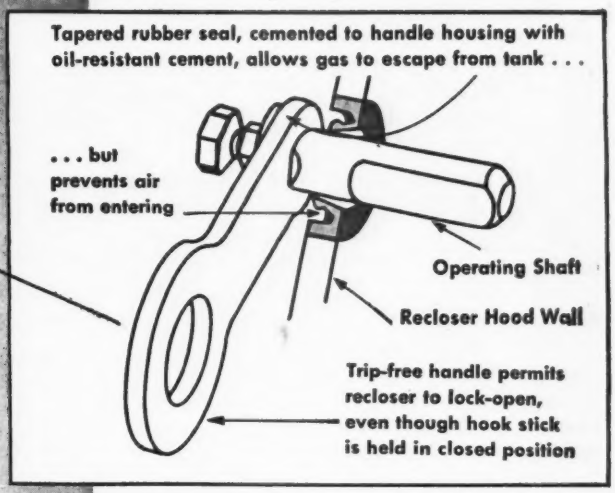
PLUGMOLD 2000



WIREMOLD'S *New* multi-outlet system

THE WIREMOLD COMPANY
Hartford 10, Connecticut




Tapered rubber seal, cemented to handle housing with oil-resistant cement, allows gas to escape from tank . . .
. . . but prevents air from entering
Operating Shaft
Recloser Hood Wall
Trip-free handle permits recloser to lock-open, even though hook stick is held in closed position

ONE-WAY VALVE SEAL combined with sealing of other parts of recloser, effectively cuts maintenance to a minimum. The sealed unit is the latest in a series of G-E design advances for reclosers—a series that included introduction of the first automatic recloser in 1934, and the recent introduction of the "hold-closed" operation.

- **Keeps out moisture**
- **Cuts maintenance to minimum**
- **Permits interruption gases to escape**

140-AMPERE FRAME recloser, new "U-shaped" mounting bracket.

G. E. introduces new "sealed handle" unit, seals recloser from moisture and dust

Exclusive feature on Type FR Automatic Reclosers up to 140 amps

With General Electric's sealed unit Type FR automatic oil circuit recloser, utilities can now eliminate their biggest recloser maintenance problem caused by moisture accumulation in the oil. They also can count on reclosers remaining in service, untouched for long periods of time, with maintenance intervals determined chiefly by interrupting duty imposed.

SEALS AGAINST WEATHER The one-way valve seal around the shaft of the recloser handle, shown in close-up above, seals against rain, snow and dust. In keeping out moisture-laden or dusty air, the seal prolongs the insulating ability of the oil . . . and permits easy escape of gases created by fault interruptions.

Type FR Reclosers are also available to co-ordinate completely with those of other manufacture.

Design-tested in G.E.'s High Capacity Development Laboratory, the "sealed unit" Type FR Automatic Recloser comes in the one-phase FR-1 model and in the three-phase FR-3—continuous current of 5 to 140 amps, interrupting capacity of 125 to 2500 amps at 2400 to 14,400 volts. For complete information on these reclosers, see your General Electric Sales Representative, or write to General Electric, Schenectady 5, N.Y.

872-5

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

You can put your confidence in—

GENERAL ELECTRIC

Check with Superior on

TEST SWITCHES

Full range of sizes and types for the best in modern metering practice.

For full information, and data on distinctive features that help you avoid trouble and cut costs, write to:

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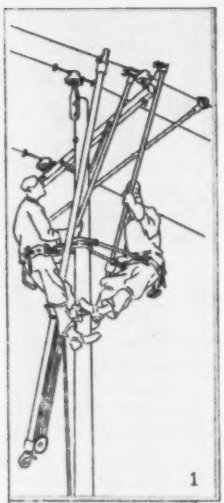
The Union Metal Manufacturing Company



NEW HAND TOOLS SIMPLIFY 13KV INSULATOR REPLACEMENTS HOT

Only conductor having faulty insulator needs to be removed for safe replacement of that insulator assembly. This saves 50% or more on the majority of 6-13KV insulator changes.

1. Install pair of saddles and wire tongs. Untie and remove phase.
2. Hold insulator pin with **UNIVERSAL PIN INSULATOR GRIP.** Remove nut with **MAGNETIC WRENCH SOCKET.** Socket holds washer, nut and MF nut.
3. Change out insulator pin assembly.

DIECK TOOLS

Catalog data available upon request.
Distributed nationally by Line Material Company

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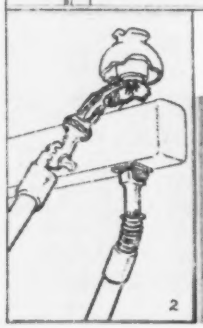
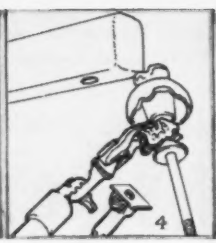




Commodore, New York, Sept. 13-17.

Northwest Public Power Association
Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17-18.

Public Utilities Association of Virginias
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 17-20.

Maryland Utilities Association
Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 18-19.

Rocky Mountain Electrical League
50th Annual Fall Convention, Broadmoor Hotel, Colorado Springs, Colo., Sept. 20-23.

National Association of Railroad and Utilities Commissioners
Hotel Roosevelt, New York, Sept. 20-26.

Edison Electric Institute
Accident Prevention Committee, Radisson Hotel, Minneapolis, Sept. 21-22; Transmission-Distribution Committee, Hotel Nicollet, Minneapolis, Minn., Oct. 8-9; Electrical Equipment Committee, Jung Hotel, New Orleans, La., Nov. 2-3.

Instrument Society of America
8th National Instrument Exhibit, Sherman Hotel, Chicago, Sept. 21-25.

International Association of Electrical Inspectors
Silver Jubilee Meeting, Edgewater Beach Hotel, Chicago, Sept. 21-26.

National Electrical Industries Show
Sponsored by Eastern Electrical Wholesalers' Association, 69th Regiment Armory, New York, Sept. 29-Oct. 2.

***Southeastern Electric Exchange**
Fall Meeting, Engineering-Operation Section, Carolina Hotel, Pinehurst, N. C., Oct. 1-2; Accounting Conference, Battery Park Hotel, Asheville, N. C., Oct. 15-16; General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 19-21.

American Society of Mechanical Engineers
Fall Meeting, Sheraton Hotel, Rochester, N. Y., Oct. 5-7; Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

Interstate Power Club
Hotel Martinique, New York, Oct. 5; Hotel Martinique, New York, Dec. 7.

Electric League of Western Pennsylvania
4th Industrial Electric Exposition, William Penn Hotel, Pittsburgh, Oct. 6-8.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 7-9.

Association of Edison Illuminating Companies
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Oct. 8-10.

National Association of Electrical Distributors
Fall Meeting, Pacific Zone, Hotel del Coronado, Coronado, Calif., Oct. 11-14.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Oct. 12-13.

Electrical Association of Philadelphia
Biennial Electrical Progress Show sponsored by Manufacturers' Division, Convention Hall, Philadelphia, Oct. 13-15.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

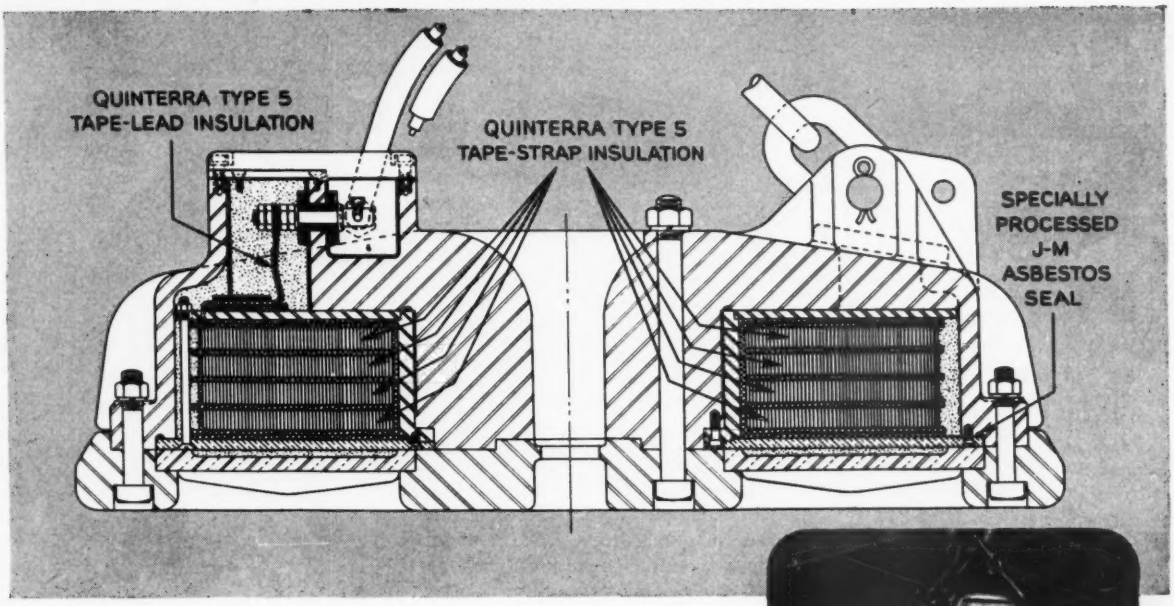
Public Information Program
Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric-Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

*Addition this week



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INDIANA
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Meeting Report

(*Continued from page* 204)

pare to demonstrate maximum resistance to puncture in pin insulators. O. W. Zastrow, REA, reported field failure in many areas of pin insulators similar to those tested by the Bureau of Standards. Failure percentage was not high but the cost of locating faulty insulators was around $100 each because of the impossibility of detecting them with conventional radio detectors.

Capacitor Economics . . . According to R. A. Zimmerman, Westinghouse, secondary capacitors have their greatest economic application when the ratio of installed cost per kvar of primary capacitors to installed cost per kva of distribution transformers is low and initial power factor is low. Using estimated cost figures secondary capacitors can be justified with distribution transformers 50 kva and below but most will be justified with transformers rated 25 kva and below. J. E. Rembusch, Commonwealth Edison, noted Zimmerman's conclusions depend on the value of losses; that cost of losses must be high to justify secondary capacitors. When transformers are worked to 125%, secondary capacitors are hard to justify. Benefits of using series capacitors on transformer primary leads to minimize flicker due to air conditioners is neutralized by secondary capacitors, he noted.

Aluminum Jointing Progress Continues

For aluminum cables, aluminum fittings are best, reported Joel Tompkins and E. K. Lanctot of Alcoa. They should be designed for only one cable size, with adequate contact areas. Compression fittings proved excellent, they said, and joint compounds are effective in sealing the contact surfaces, preferably even forced between the strands of stranded cable, they said.

Some types of tin-plated copper fittings proved satisfactory, they said, when used on soft aluminum cable and with a suitable joint compound. But elasticity is necessary to compensate for differences in expansion coefficients. They advocate heat cycle tests for determining the suitability of fittings rather than the initial resistance

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GUARANTEED FOOTAGE — you get full measure in every roll.

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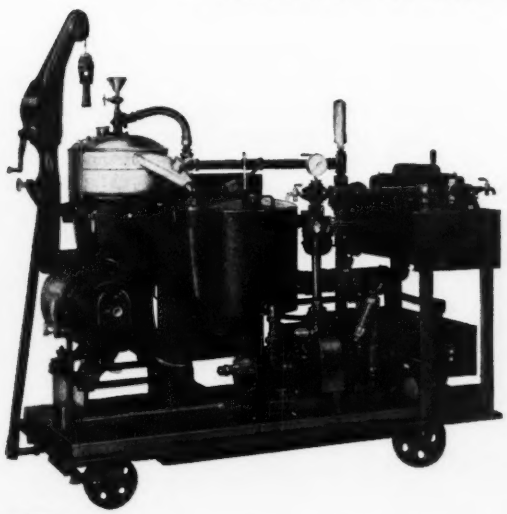
35 KV

or even better!

So efficient is the De Laval method of purifying insulating oil that it is possible to guarantee that when operated at its rated capacity, each De Laval Insulating Oil Purifier will reduce the water content of new transformer oil at a temperature of 90° F from an initial 1/10 of 1% to 1/1,000 of 1% (one part of water in 100,000 parts of oil)—at 35 kv dielectric strength.

As a matter of fact, the 35 kv figure is often exceeded in actual practice.

De Laval accomplishes its purification in a single pass through the centrifuge. The dehydration is accomplished without the aid of a filter press, although one is usually furnished for the removal of colloidal carbon from circuit breaker oil.



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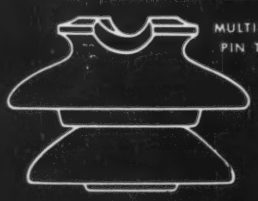

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or any temperature rise.

Successful jointing of aluminum buses for substations by use of silver plating on the contact surfaces was reported by T. J. Connor and W. R. Wilson, General Electric. Earlier difficulties in bonding silver to aluminum have been overcome, they said, by a new electroplating process. This process comprises: thorough cleaning of the aluminum, application of a bright zinc coating by chemical displacement, electrolytic plating with silver. Coating of zinc chromate is desirable.

Transformers Are Safer— Life Longer Too

Extensive tests of sealed dry-type transformers prove there is practically no danger of fire, said E. W. Tipton of Westinghouse. While the Class H transformer failed at 600% load, when the low voltage coil approached the melting point of copper, there was no disturbance of any kind, he said. Despite decomposition of most of the silicone, and considerable evolution of gas, the mixture would not explode.

Indications that distribution transformers have life expectancies many times those assumed in the ASA Guide for Loading Transformers were reported by W. A. Sumner, G. M. Stein and A. M. Lockie, Westinghouse. Cyclic tests showed that the end point of life corresponds to 20 years continuous operation at 122 C hot spot.

In discussion Robert Hickson, Long Island Lighting Co, said overload protection in SCP transformers is causing two breaker operations to every burnout or fuse operation in conventional transformers. He felt that more rapid loss of transformer life is preferable to customer interruptions.

Conventional methods of utilizing oriented steel laminations for three-phase cores have been disappointing with respect to losses and exciting current, said F. C. Roeding of Westinghouse. They tend to produce a large percentage of harmonics. But a two-legged core design with the third leg joined at the middle and extending outward at 90 deg satisfies these requirements and has valuable manufacturing advantages, he said.

Crepe Paper Insulation . . . Two-way-

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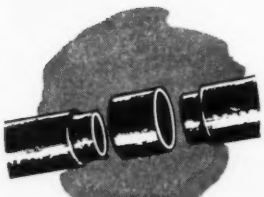

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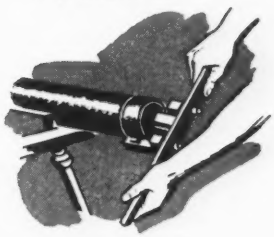
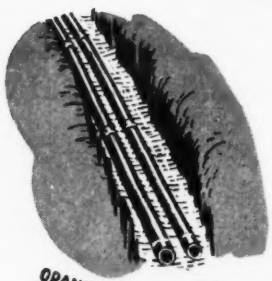


EASY TO TOOL



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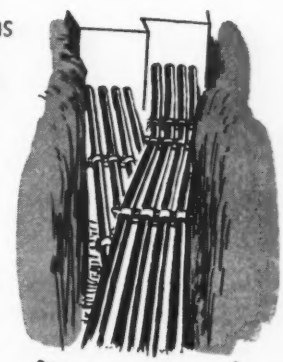

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stretch paper is now supplanting varnished cambic for insulating conductors in transformers, according to G. Camilli, L. Mulligan and E. L. Crandall, General Electric. This new paper tape is physically and electrically equal or superior to varnished cambric. A second form creped one way only has been used to insulate the coils.

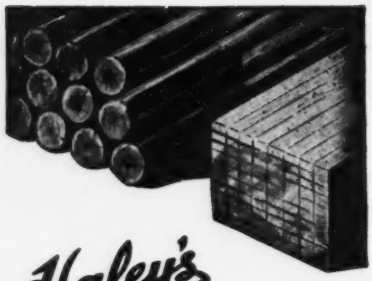
About 75% of power transformers 10,000 kva and larger are factory-equipped with forced-air cooling and many more subsequently have fans added in the field, said W. D. Albright, Westinghouse. It would be impractical and uneconomical, he said, to build units above 150,000 kva without forced air cooling. One popular practice is to provide transformers with self-cooled capacity adequate for the normal load, reserving the fans for emergencies and unexpected peaks. But usually the reduced losses of a fan-cooled transformer would justify continuous operation of the fans, he said.

Welders Can Triple Cost of Distribution

Electric rates to cover service to welders must be higher than that for normal industrial loads. The cost of distribution facilities to provide for a welding load may run in a range of $286 to $370 per kw compared with a norm of $99 to $131 per kw. The cost of supply to the welder alone can run from $258 to $404 per kw for a separate 4.16 kv supply and from $1040 to $1715 per kw for a separate 34.5 kv single phase supply.

These costs were reported in the paper by R. E. Young, Power Engineer, Public Service Co Division of Commonwealth Edison Co. Young pointed out that the energy used for welding can be measured by conventional watthour meters, but the maximum demand is not readily measured by ordinary meters. As a result, the utility's special charge for extra facilities must of necessity be made on another basis than that for normal loads.

Several methods adopted by utilities for obtaining additional compensation for welding loads include: 1. A surcharge for additional cost of facilities. 2. Special rate minimum charges. 3. Increase in demand charge. 4. Some combination of above methods.



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with ONAN portable
ELECTRIC PLANTS

Take em Anywhere!

Use Electric Tools on Every Job

Carry, wheel, or truck 'em to any spot and plug in for all the electric power you need. Lightweight, Onan air-cooled electric plants supply power for electric drills, saws, planers, spades, tampers, lights . . . any electrical equipment. Lightweight A.C. models: 400 to 10,000 watts, D.C.: 750 to 5,000 watts. (Heavy-duty water-cooled models: 5,000 to 35,000 watts). Diesel plants also available.

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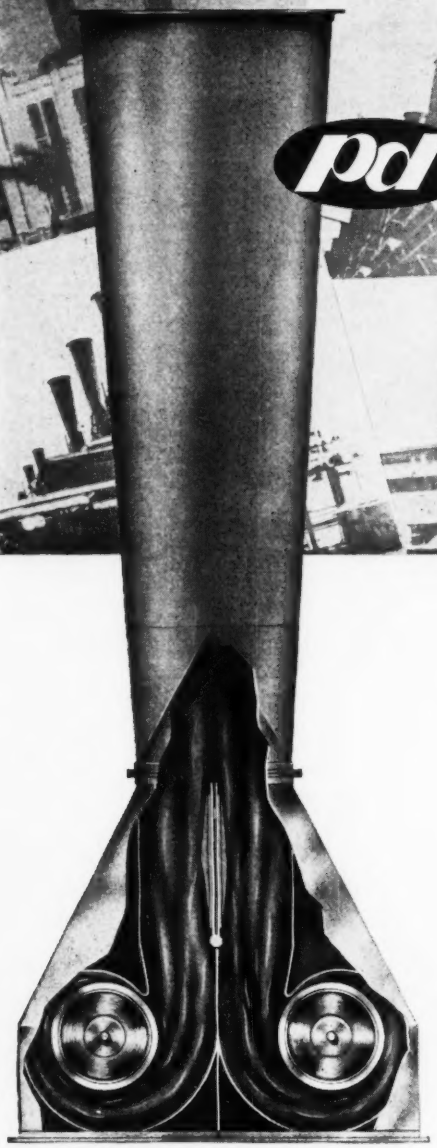

The wheels of industry move on *power*—generated by power plants that must produce economically, be trouble-free and operate for long periods with a minimum of maintenance.

Efficiency of the boiler is vital . . . stacks must insure this efficiency with a minimum of heat loss, must guarantee predetermined draft production, must assure correct static pressure at all times.

Stack efficiency often means boiler efficiency. That's why many of America's most efficient power plants are Prat-Daniel equipped.

These power plants specified P-D Stacks because:
1. Breeching, fan and stack are built as *one* unit.
2. Losses due to breeching bends are eliminated.
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4. P-D stacks are designed to fit specific power needs.

In the design illustrated, for example, two fans are utilized for widely fluctuating loads. Each fan handles approximately 70% of total volume. Second fan may be automatically cut in. The one stack may be used on two boilers.

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ARCO Throwing Weight Without Rope	$3.00 Ea.
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Weight without rope	13-½ oz.
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New Breaker Shuns Mechanical Operators

Neither advantages nor disadvantages are found in use of DBPC—inhibited oils in circuit breakers, said W. M. Leeds, Westinghouse Electric Corp, and R. F. Seubert, Koppers, Inc. Tests covered rate of carbon settling, size of carbon particles, presence of moisture, arcing, and power factor. But discussion by K. G. Darrow, General Electric Co indicated some improvement in its aging characteristics. He said inhibited oil is preferred for sealed oil circuit reclosers where it extends the maintenance periods.

An increasing trend away from mechanical operating mechanisms for large oil circuit breakers is evident. E. E. Briggs, R. D. Hambrick and D. M. Umphrey, all Pacific Electric Manufacturing Corp, described a new hydraulic actuator suitable for the largest high-capacity breakers.

Cold Weather A Threat . . . The very low winter temperatures encountered in Idaho, Montana, Minnesota, the Dakotas and Canada may create operating problems for outdoor oil circuit breakers, said E. B. Rietz, General Electric Co. He advocated heating units to prevent frozen condensate in pneumatic operating devices, and attention to both insulating and lubricating oils.

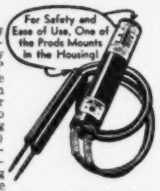
"The advent of larger generators has created a demand for field breakers with larger current and voltage ratings", said M. E. Horn and J. C. Cunningham of Westinghouse. Because system or main winding faults impose the most severe interrupting duty, an equivalent circuit was derived for that condition. A new breaker, rated 1,600 amp at 250 v, simultaneously removes excitation and connects the field resistor to discharge the field at a safe rate, they said.

Relay Progress Proved Rapid

In a pilot-wire relaying scheme for a 138-kv solidly-grounded transmission system, D. W. Gilman and R. I. Ward, both Commonwealth Edison Co, reported that in using "CFD" relays, test showed: **1** the scheme would not trip through fault currents up to 20,000 amp, symmetrical or offset; **2** it would not trip on line charging currents; **3** it would trip both

The Exclusive* Prod-Mount Voltage Tester is the KNOPP

*The Prod-Mount is completely covered by a patent held exclusively by Electrical Facilities Inc.



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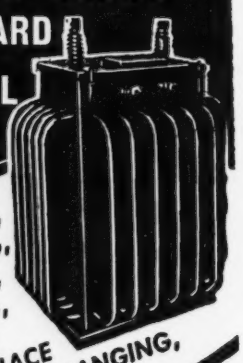

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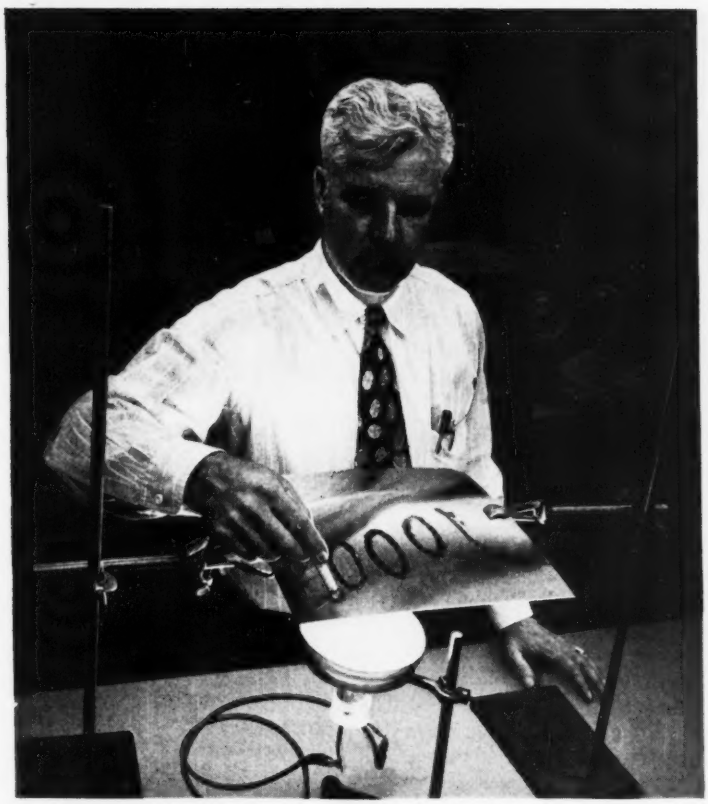

IN JUST 5 SECONDS, the markings from a temperature-indicating crayon, rated at 1,000°F., melts to liquid on a metal sheet placed a few inches over the Sylvania Instant Heat Cooking Unit.

NEW SYLVANIA UNIT BRINGS

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TO ELECTRIC RANGES

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After several years of exhaustive research, Sylvania Engineers have developed a new and amazingly fast-operating top heating unit for electric ranges.

Essentially, this is an infrared lamp of 1550 watts mounted in a metal reflector, and covered with a red, heat-resistant glass top. The inside of this lamp is *GOLD-COATED* because gold coating gives the highest heat reflection.

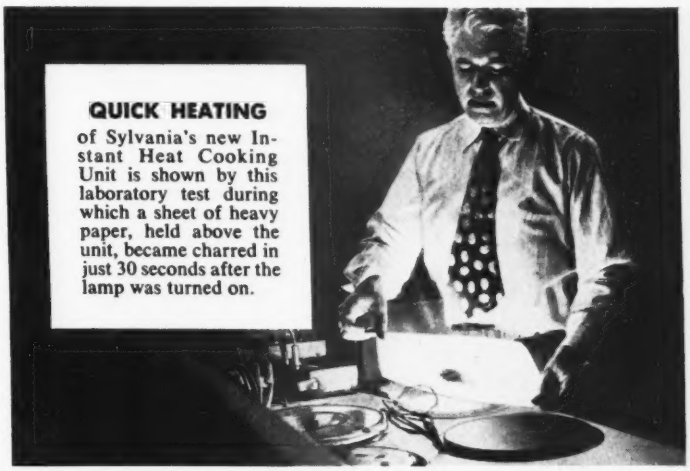
Instead of gradually conducting heat to a cooking pot or pan, this unit instantly *radiates* heat at full blast. And, because there are no thick wire coils or metal tubing to absorb the heat, you get desired high temperatures at the flick of a switch.

With this unit, bacon fries in 30 seconds. Fried eggs are cooked in 2 minutes; frozen vegetables are steaming hot in 3 minutes.

Heat you can see!

No guess work whether or not this new unit is turned *on*. The infrared lamp immediately signals "hot" with a cheerful red glow.

And for details about this 1550 watt infrared lamp's use in industrial applications, write to: Sylvania Electric Products Inc., Dept. 3L-2707, 1740 Broadway, New York 19, N. Y.



QUICK HEATING of Sylvania's new Instant Heat Cooking Unit is shown by this laboratory test during which a sheet of heavy paper, held above the unit, became charred in just 30 seconds after the lamp was turned on.

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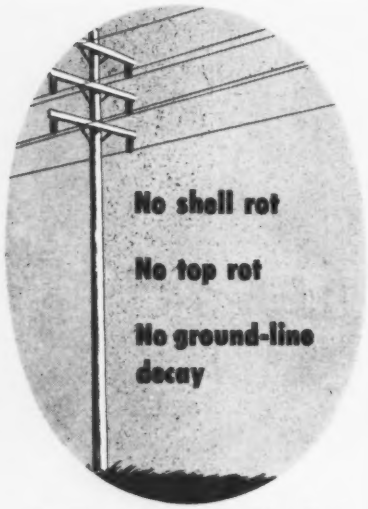

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ends of the line on single end feed currents of 2,000 amp or greater; and 4 it would perform satisfactorily on pilot wires up to 125 ohms resistance and 4 mfd capacitance; equivalent for a pilot wire up to 16 miles in length.

Electronic mho distance relays on a 50-mile, 88-kv line in West Virginia "were not adversely affected by unknown system or other disturbances which may have occurred during the operating test period" reported H. C. Barnes of American Gas & Electric Service Corp. and R. H. Macpherson of General Electric.

Application of phase comparison relaying to three-terminal lines requires careful study, stated H. W. Lensner of Westinghouse Electric Corp. Such relaying with high-speed reclosing can be applied to three-terminal lines if a sufficiently large differential exists between fault and load currents he said. Where the third terminal supplies only a relatively small load and the generation is negligible, the relays can operate as for a two-terminal line. If faults beyond the third terminal pick up the relays at the other two terminals, a carrier blocking scheme can be used at the tap.

Measure Temperature of HV Conductor

Copper temperature of a high-voltage generator conductor can be determined with a temperature potentiometer, described by H. E. Brown and A. L. Brownlee, both of Commonwealth Edison Co. The instrument measures the temperature drop through the insulation.

Contract Extension OK'd

The Department of the Interior has approved a 10-year extension of San Francisco's contract with Pacific Gas & Electric Co under which PG&E distributes power to certain large order Hetch Hetchy customers. City Attorney Dion R. Holm received the notification, which some city officials considered a significant indication of the new Administration's attitude toward distribution of public power by a private utility. PG&E distributes Hetch Hetchy power to the municipal departments, Kaiser cement and magnesium plants, the Riverbank Ordnance Depot and the Modesto-Turlock Irrigation District.

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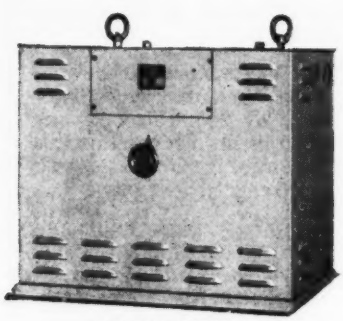
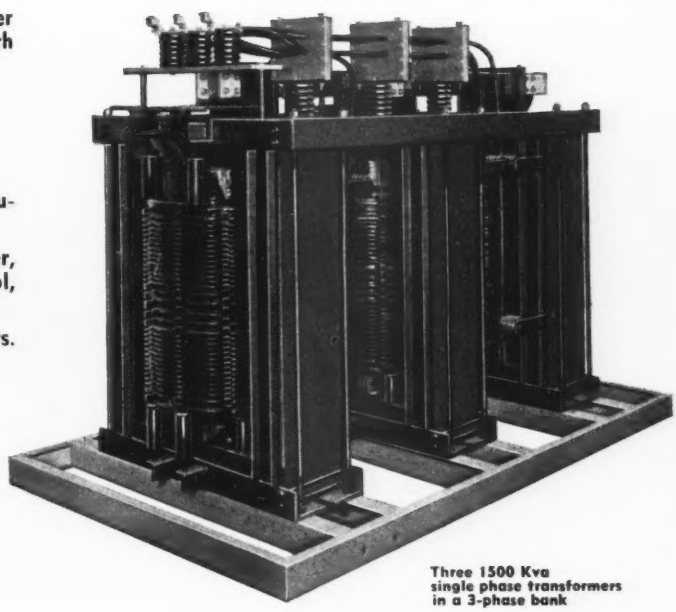


D.C. Saturable Reactor with potentiometer control



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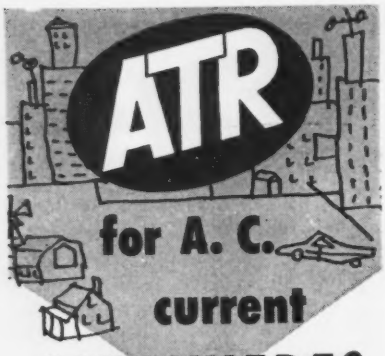

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32-RSD	32	110	150	100	39.25
110-RSD	110	110	250	150	39.25
*12T-HSG	12	110	250	200	96.45
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Tacoma City Light to Add Unit at Steam Station

Power shortage of last winter and lack of progress in federal plans to increase regional power supply has spurred Tacoma City Light to add 20,000 kw to generating facilities of its Steam Plant No. 2. Built in 1931, the plant has more than sufficient total boiler capacity for existing 25,000-kw unit. Two 200,000 lb/hr boilers will be water-walled to increase output of each to 260,000 lb/hr so that either one can carry original unit. Added steam capacity will operate the new 20,000 kw turbine, scheduled for delivery in December 1953.

Present cooling water capacity is sufficient to accommodate condenser for the new unit. Addition to machine room will be built to house the new turbine, to be served by extension of the present crane runway.

Further increase in capacity may be secured by installation of gas turbines later on. By use of waste heat from turbine exhausts to heat feed water through heat exchangers, maximum capability of new 20,000-kw unit at unity power factor and 30 psig hydrogen would be 31,250 kw. Output of two gas turbines would increase total plant capacity to something over 65,000 kw.

Site Clearing Started for Vermilion Reservoir

Site clearing and stripping has been started for Southern California Edison Co's $8.5 million Vermilion Valley power reservoir.

A further development of Edison's Big Creek-San Joaquin River hydroelectric facilities, the project will permit addition of an annual 122 million kwhr to present output of the company's six existing powerhouses in the area, or as much as 440 million kwhr in exceptionally dry years.

Vermilion Dam, to be built across Mono Creek in Fresno County, will be an earth-filled structure 160 ft high with a crest length of 4,234 ft. It will form a reservoir with a capacity of 125,000 acre ft.

The dam will not only provide additional regulation and water storage for Edison's powerhouses, the company points out, but will help San Joaquin Valley residents by providing

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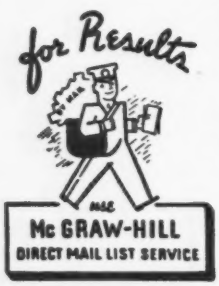

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more irrigation water during dry years and increasing conservation and flood control facilities.

Way was cleared for preliminary work on the project by receipt last month of Federal Power Commission permits and signing of a contract between Edison, Bureau of Reclamation, and water users in the area covering operations of the projected reservoir.

Edison has also applied to FPC for permission to build a project including a powerhouse and another reservoir at nearby Mammoth Pool, on the upper San Joaquin River. The powerhouse will have a generating capacity of 126,000 kw.

Federal Control of TVA Will Be Rejected: McKee

A prediction that "you will see the citizens of Tennessee proposing to take out of federal hands the power facilities of the TVA" was voiced by the president of Pacific Power & Light Co, Portland, Ore, at a meeting of California investment bankers June 29.

Paul B. McKee told California members of the Investment Bankers Association of America "the day is not far off" when Tennessee citizens will reject the federal control "in spite of all the bounties that have been bestowed upon them." He added, "They will do this because the only way to be sure of having an adequate power supply is to have it developed on a commercial basis."

McKee contended that experience with past federal power policies has made many public agencies in the Pacific Northwest as well as private utilities see the necessity of putting power development on a commercial basis. He also stressed his belief in "the practical necessity of local agencies taking greater part in the river resources development program."

The utility president, speaking at the bankers' annual meeting in Santa Barbara, estimated that increasing power requirements in the Pacific Northwest will call for $240 million a year in new generating and distribution facilities between now and 1960. He said demand for power in the area has been increasing at the rate of 10% a year, requiring an annual increase of 400,000 kw of generating capacity.

Power from Atom Far Off, Swedish Authority Says

Atomic energy cannot compete on an economic basis with water power in Sweden for many years to come, according to Harry Brynielsson of Atomic Eenergy Co, Inc, founded in 1946 and financed jointly by the government and private enterprise.

As a source of energy for Swedish industry, he said, atomic energy is not expected to become practical for about 20 years, or about the time when Sweden's water power resources presumably will have been fully harnessed.

Research and experiment in atomic power is, however, being pursued energetically in Sweden. An experimental reactor of 100 kw, the first in Sweden, will be ready early next year, and the Atomic Energy Co expects to build a 10,000 kw reactor to be used principally in further experimentation.

British Columbia Electric to Install 120,5000 Hp

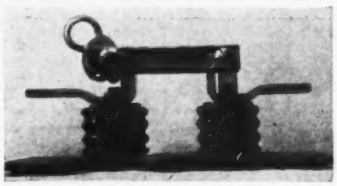
A $13-million hydroelectric development is being undertaken by British Columbia Electric Co, which will add another 120,500 hp to the power supply of British Columbia's expanding Lower Mainland area. One feature will be a new power plant to use water already utilized in the company's Bridge River plant.

Development falls into two projects: The addition of a fourth 62,000 hp generator to the Bridge River plant at a cost of $5 million; and the building of a completely new $8-million power station at the mouth of Seton Creek, about 25 miles east of the Bridge River plant.

Since World War II, BCE has boosted its Lower Mainland capacity from less than 250,000 hp to 608,000 hp. Two years hence the figure will go up to 728,500 hp.

BEA Reports Savings

Increased thermal efficiency (up 0.82%) to a national average of 22.61% saved British Electricity Authority £3,000,000 during 1952. Plans for replacement of over-age equipment aim at an overall efficiency of 26% by 1960.



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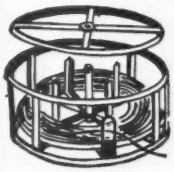

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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column. 3 columns—30 inches—to a page.

SEND NEW ADVERTISEMENTS TO: 330 W. 42 St., 36, N. Y., for July 27th issue closing July 20th

EARTH AUGER SALESMEN

Demonstrate and sell the well-known PENGO Earth Augers and related products to Utility and Telephone Co.'s, Contractors, State and Federal Govt. Agencies. We furnish Ford Ranch Wagons with sample and demonstrating augers, pay traveling expenses and drawing account against commissions. PENGO Augers are easier to sell than anything we know of. A real good job for real good men. Send full qualifications and snapshot if available, stating whether you have had line construction experience, to Sales Mgr.

PETERSEN ENGINEERING CO. MFRS.
Santa Clara California

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ADMINISTRATIVE Vice President in 38-45 year age bracket. Qualified to coordinate operating, commercial, and accounting functions and administer company's organization and operations. Operating and/or engineering experience essential. Familiarity with rate case preparation and presentation, accounting, san sales promotion desirable. Preferred consideration given to those with multi-utility, combination experience, such as electric-gas, telephone-gas, electric-water, telephone water. Eastern location. Consideration given only to those submitting detailed resumes, including compensation in present employment. Starting salary range (dependent on qualifications)—$13,500-20,000. P-8264, Electrical World.

VICE-PRESIDENT, Operations, in 38-45 year bracket. Qualified to assume full, final responsibility for operations, engineering, and construction. Operating and engineering experience absolute requirement; familiarity with rate analysis, labor negotiations, analysis of manpower requirements desirable. Sufficient experience, knowledge and background to handle all operating and engineering problems of diversified utilities company. Multi-utility experience absolute essential, such as combination electric-gas, telephone-water, etc. Eastern location. Consideration given only to those submitting detailed resumes, including compensation in present employment. Starting salary range (dependent on qualifications)—$12,000-$15,000. P-8265, Electrical World.

INSTRUCTOR, ELECTRICAL Engineering to teach Service courses and Industrial Electronics, beginning September, 1953. Salary and rank open. Apply Electrical Engineering Department, University of North Dakota.

RIGHT OF WAY Agents to acquire electric transmission line rights of way in eastern seashore area. Excellent opportunity with minimum employment of 18 months. Write full details, experience and salary expected. P-8397, Electrical World.

ELECTRIC SUPERINTENDENT: Small independent electric system needs superintendent of generation and distribution, preferably with engineering degree, to supervise 11,000 Kilowatt Steam Plant and urban overhead system. Write all details to J. G. Cree, Borough of Chambersburg, Pennsylvania.

ELECTRIC GENERATING Plant Superintendent. To supervise municipal plant and distribution system in eastern Pennsylvania. Town of ten thousand population, pleasant country to live in located within about two hours of mountains or seashore. Submit biographical sketch of education, experience and personal background. State salary expected. Replies held confidential. P-8436, Electrical World.

POSITION VACANT

ELECTRICAL PROPERTY Manager in 35-45 year age bracket. Qualified to handle and administer operating commercial and construction activities for 10,000 customer property. Must have actual over-all utility company operating experience; familiarity with public relations, wholesale power sales, work with community organizations and manpower scheduling desirable. Northeastern location. Starting salary range (dependent on qualifications) $6,500-$7,500. P-8161, Electrical World.

EMPLOYMENT SERVICE

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 43 years.) Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER, P.E.—N.Y., 31, 5 years Public Utility and Consulting Engineer, experience with network and transient analyzer studies, relaying, carrier, etc. Desires position with public utility. PW-8175, Electrical World.

ELECTRICAL ENGINEER, 38, 15 years Public Utility experience in power sales, electrical distribution and special studies. Desires work in power sales or district representative for utility. PW-8455, Electrical World.

ENGINEER, EXTENSIVE UTILITY experience with medium-sized electric property in transmission operation, division manager, franchise negotiations, wholesale rate negotiations, rates of earnings, and plant values, and special investigations. Available July 1, 1953. PW-8269, Electrical World.

SELLING OPPORTUNITY WANTED

SALES ENGINEER, Young EE—for home office sales work, with utility meter experience. Large manufacturer located in Pittsburgh area. Some travelling. Salary open. Reply with photograph (optional) and complete resume of education and experience. SA-8332, Electrical World.

CONTRACT WORK

Injection Moulding. Capacity Available; Modern Plant; Long runs essential. Lewis Woolf Limited, 144, Oakfield Road, Selly Oak, Birmingham, 29, England.

CAPACITORS WANTED

Twelve only, 50,000 volts D.C., .45 microfarads or twenty-four only, 25,000 volts D.C., .85 microfarads. These capacitors are for indoor use. Metal enclosed or porcelain type acceptable. Any capacitors approximating this requirement will be considered. Address all replies giving full details to:

Supreme Power Supplies Limited
Toronto 14, Canada
Attention Purchasing Department

ADDITIONAL SEARCHLIGHT ADVERTISING on the opposite page

he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

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FOR SALE

3—1000 KVA Mol 11500-2400/4160Y
3— 500 KVA G-E 22000-2300/4000Y
3— 333 KVA W-H 13200-2400/4160Y
3— 333 KVA W-H 660-2300
3— 333 KVA Mol 7200/12470Y-2400/4160Y
3— 250 KVA G-E 6600-575
3— 150 KVA G-E 19050/33000Y-2540/4000Y
2— 150 KVA G-E 6900-230/460
3— 100 KVA G-E 33000-6900/11950Y
3— 100 KVA G-E 13200-2300
3— 50 KVA A-Ch 33000-6900/11950Y
3— 50 KVA A-Ch 33000-2400/4160Y

Many other items in stock.

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Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO
40 Years Dependable Service

PRESSURE VESSELS

Immediate Shipment

Attractively Priced for Quick Removal

8—10' ID dia. x 40' x 3" shell. Heads 3½" Test Presure 900 psi. WP 600#
5—10' ID dia. x 40' x 2½" shell. Heads 3" Test Pressure 750 psi. WP 500 psi.
6—8' ID dia. x 40' x 2" shell. Heads 2¼" Test Pressure 750 psi. WP 500 psi.

All used, good condition, seam to seam welded construction. May be adapted for use as Air Receivers, Reactors, Storage Tanks, etc. Located near Chicago, Ill. Prints, prices available upon request.

WIRE—PHONE—WRITE

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817 South Boulder • Tulsa, Okla.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Q. KW	Make	Resc.
1—1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1— 750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1— 500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P.; 240/480-3-60
1— 300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

Qu	Kva	Make	Cycles	Voltages
1	12500	Whse.	25/60	13200 x 13200
1	3750	G.E.	25/60	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu	KW	Make	Speed	DC - Volts	AC Volts
1	2000	G.E.	514	600	6600/13200
2	2000	G.E.	500	666	25 cy. 11000
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1500	G.E.	360	275	2200/4400
3	1500	G.E.	514	250	6600/13200
1	1500	G.E.	600	600	2300/4150
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	900	250	6609/13200
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300
1	400	G.E.	720	250	440/2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OISC		3200x480/2400
3—1000	G.E.	HVDDJ	1	2200/480

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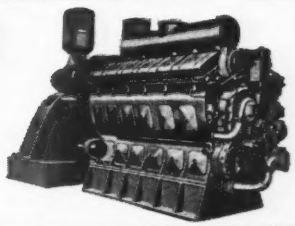
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1500	Fairbanks Morse	33E16	2000	300	300	General Motors	8-268A	450	1200
1136	Fairbanks Morse	38D	1600	720	250	Fairbanks Morse	37-E	375	360
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Buckeye	80	240	600
500	General Motors	8-278A	750	720	100	Worthington	BB-5	150	600
500	General Motors	8-567	720	720	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-S	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

TURBO GENERATOR
Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525° F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
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WORLD'S LARGEST INVENTORY
FREE CATALOG
MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

ELECTRIC CABLE
- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinary stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
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REBUILT AND NEW
GUARANTEED MOTORS
M.G. SETS • GENERATORS
Hoists • Compressors • Transformers
Units of Every Size and Description
WE'LL SELL, BUY OR TRADE
CHICAGO *Electric Co.*
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Chicago 8, Ill.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1936-1943 NORTH BERGEN, N. J. N Y C Tel. Lackawanna 5-3271 N. J. Tel. Union 26

TRANSFORMERS
1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
3— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.

SYNCHRONOUS MOTORS
1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

MOTOR GENERATOR SETS
1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 126/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS
2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West.,CW. 600 RPM, 440V.
1— 200 H.P., West., CW. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.

Large Stock of A.C. and D.C. Equipment

Communist machine-gun fire dropped him in combat. But whole blood kept him alive, saw him through the hospital. He thanks you for his life.

She'd been exposed to polio. A new serum, *Gamma Globulin*, made from blood, helped ward off the dread disease. She thanks you for her life.

A tornado whipped suddenly across her home town. She was badly injured by falling debris. But a quick operation, several transfusions pulled her through. She thanks you for her life.

Three grateful people say: "we're HERE... because you were THERE!"

Each one of these people is alive today because someone gave blood.

If you've given blood before, you know how easy it is—how quick and painless. And you know what a wonderful feeling it is when you realize that what you've done may give another person his life.

Now you are asked to give blood . . . again and again. And you can do it safely every 3 months.

Because America's need for blood has increased enormously—for our armed forces, for accident and disaster victims at home, for new disease-fighting serums.

Many a life hangs in the balance! Will you help? Call your Red Cross, Armed Forces or Community Blood Donor Center today!

BUSINESS EXECUTIVES CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLANT BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOODMOBILE MAKE REGULAR VISITS?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . the need for blood is **urgent!**

NATIONAL BLOOD PROGRAM

GIVE BLOOD

...give it again and again

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SEARCHLIGHT SECTION
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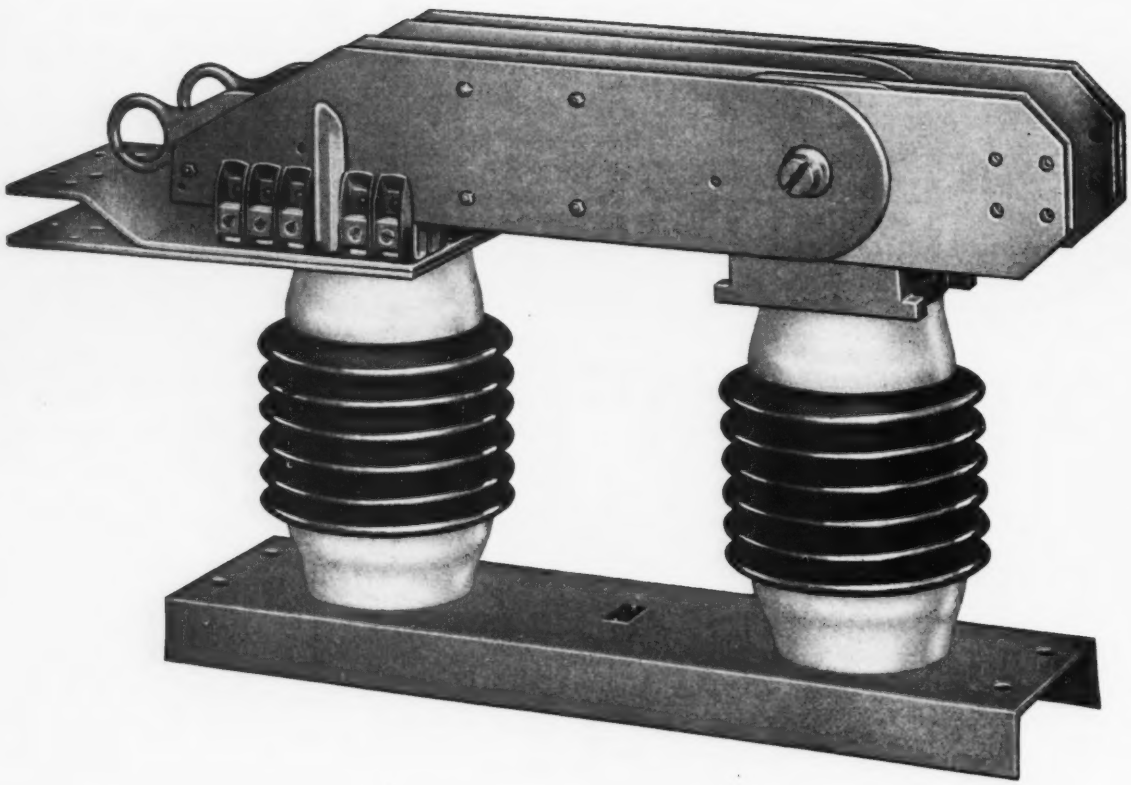
Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

TExas 0-4701



OUTDOOR HOOK STICK DISCONNECTING SWITCH

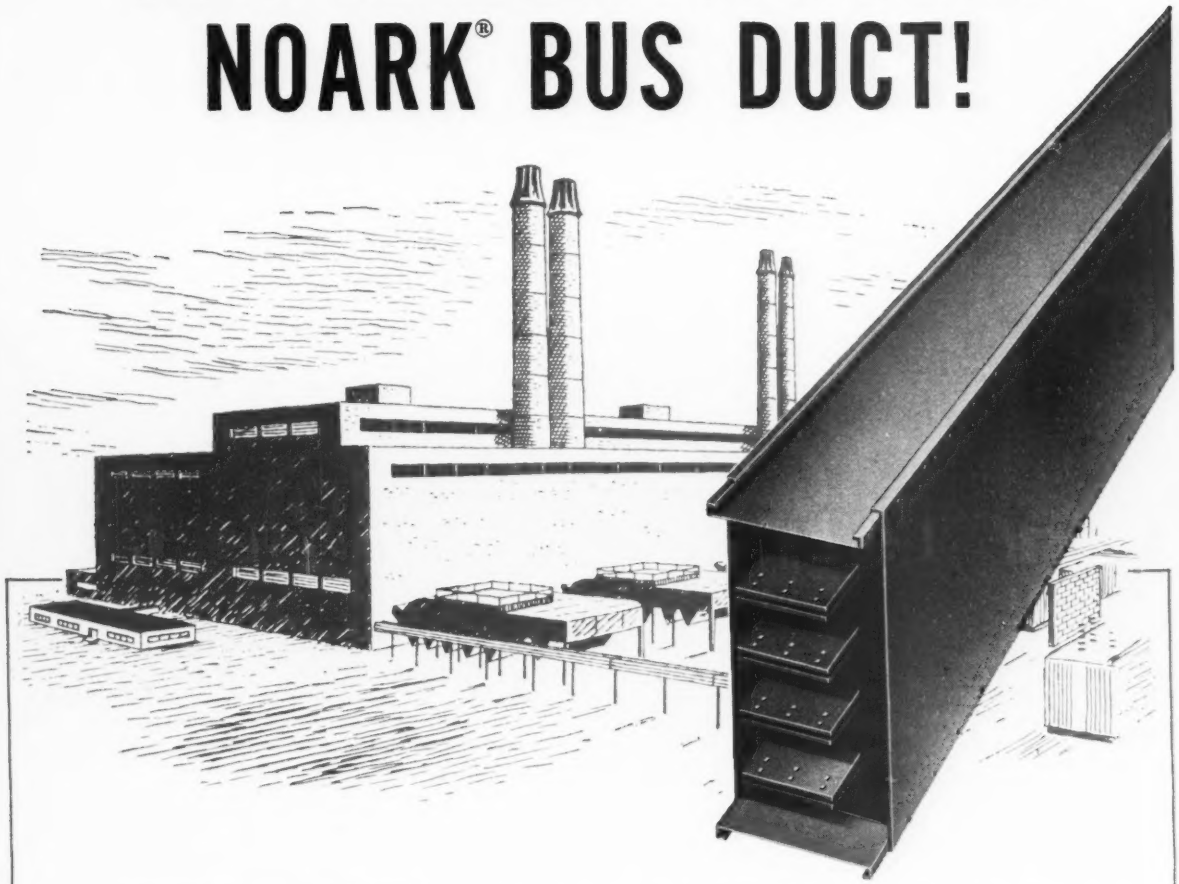
23,000 Volts—4,000 Amperes—Type Y-2

Single Pole, Single Throw

See Bulletin 20-A

SILVER TO SILVER CONTACTS

CON EDISON CHOOSES NOARK® BUS DUCT!



CONSOLIDATED EDISON'S new Astoria electric generating plant, across the East River from Manhattan, is nearing completion. Furnished throughout with the most modern and efficient equipment, Federal Noark feeder type Bus Duct of 2000 and 3000 amp. capacity has been installed to carry power to the motors driving the forced draft fans and boiler feed pumps. Designed to meet Consolidated Edison's low temperature specifications, the bus bars are specially wrapped and the bus duct housings are of aluminum. Installation was made by Lord Electric Company, Inc., New York City.

Federal Noark's standard line of bus duct has no equal for speed of installation, low-cost maintenance, and operational ease, speed and economy. In addition, Federal Noark, with its unusually wide experience, is outstandingly qualified to design and build special bus duct for the exact requirements of particular applications.

To assure top results on every usual and unusual demand for a bus duct electrical distribution system, write for the full Federal Noark Bus Duct story.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

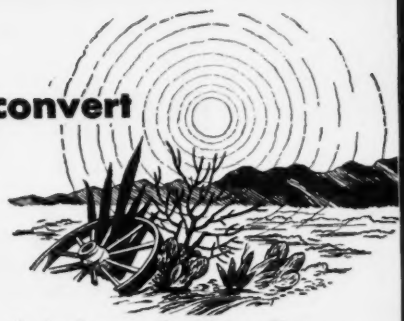
Plants at Newark, N. J.; Long Island City, N. Y.; Hartford, Conn.; Cleveland, Ohio; St. Louis, Mo.; Dallas, Texas; Los Angeles, Calif. Affiliated plant, Toronto, Canada.

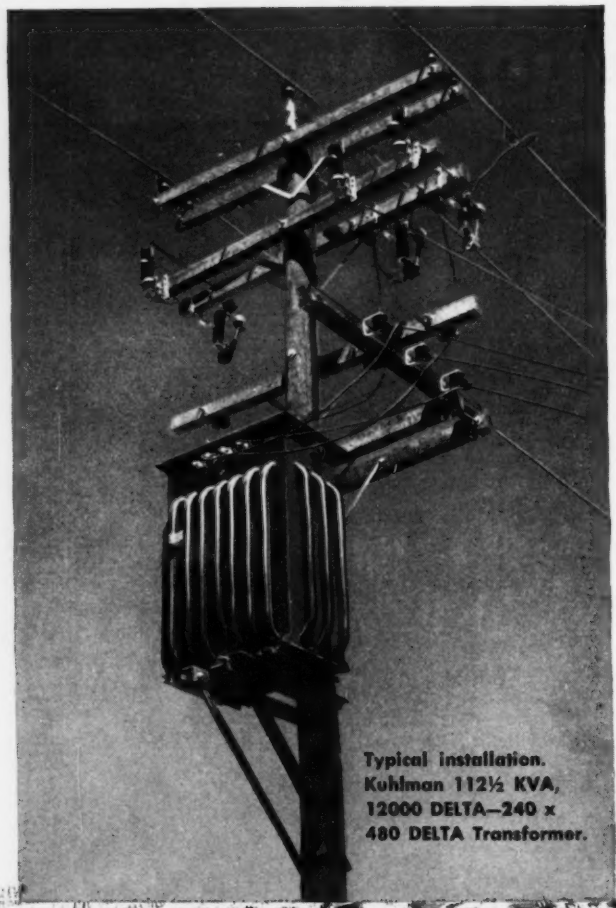
Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

FEDERAL NOARK®

Federal NOARK

74 KUHLMAN TRANSFORMERS help convert arid desert into fertile farmland





Typical installation. Kuhlman 112½ KVA, 12000 DELTA—240 x 480 DELTA Transformer.

A few years ago, the land surrounding Pecos, Texas, was a vast tract of sandy desert where mesquite, cactus and catclaw were the principal vegetation. Today, this same land produces a bountiful harvest of cotton, cantaloupe, alfalfa, grain sorghum and many other crops. For electricity, providing the energy to pump water from irrigation wells, has made it possible to reclaim thousands of acres of the parched range land. Seventy-four Kuhlman three-phase Transformers helped accomplish this miracle.

Kuhlman Transformers have been serving agriculture and industry with dependable equipment for more than 60 years. Kuhlman Transformers include power, distribution, dry type, Saf-T-Kuhl, subway, rural, series and C.S.P.

The new modern plant of Kuhlman Electric Company at Crystal Springs, Mississippi is ready to supply the needs of utilities and industries throughout the South. Write today for complete information.

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